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Evaluation of ST3000 Smart Transmitters for:
- Differential Pressure, models STD120 and STD924
- Gauge Pressure, models STG14L and STG94L

Manufacturer: Honeywell Inc., Phoenix, USA

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Subject: **EVALUATION OF ST3000 SMART TRANSMITTERS for:**
- **DIFFERENTIAL PRESSURE, models STD120 and STD924**
- **GAUGE PRESSURE, models STG14L and STG94L**

Manufacturer: Honeywell Inc., Phoenix, USA

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Photograph of the instruments

From the left to the right : STG120-STG94L-STD924

Not shown : STG14L

ST3000 SMART TRANSMITTERS

- **DIFFERENTIAL PRESSURE, models STD120 and STD924**
- **GAUGE PRESSURE, models STG14L and STG94L**

Manufacturer: Honeywell Inc., Phoenix, USA

Evaluated by TNO-EIB on behalf of International Instrument Users' Association - WIB and the manufacturer

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December, 2000

1. INTRODUCTION

This report describes the evaluation of ST3000 Smart transmitters for Differential Pressure (ΔP) and for Gauge Pressure (GP). The instruments were standard production models, manufactured by Honeywell Inc., Phoenix, USA.

The type, model code, upper range limit (URL), software version and accuracy figures of the instruments are:

Instrument Type	ΔP Series 100	ΔP Series 900	GP Series 100	GP Series 900
Model	STD120	STD924	STG14L	STG94L
Upper range limit (URL)	1000 mbar	1000 mbar	35 barg	35 barg
Software version	3.5	B.5	3.5	B.5
Accuracy[1], analogue output	0,075 %	0,10 %	0,075 %	0,10 %
Accuracy[1], digital output	0,0625 %	0,075 %	0,0625 %	0,075 %
Turndown ratio, without loss of accuracy	16 to 1	16 to 1	25 to 1	25 to 1
Turndown ratio, maximum	400 to 1	40 to 1	100 to 1	25 to 1

[1] Accuracy is specified as terminal based, including linearity, hysteresis and repeatability.

The instruments were evaluated to a test programme drawn up by TNO-EIB based on the Standard WIB Test Program for Pressure transmitters, V 2: 23 February, 1995. The test programme was extended with 'Aggravated tests' that exceeded the severity of the standard WIB tests. The STD120 was subjected to all tests. The other instruments were subjected to a limited set of tests from the overall test programme. EMC tests were excluded. Angle mounting brackets were delivered for the vibration tests.

The transmitters convert the measured value proportionally into either a 4...20 mA analogue output signal or in a digital DE protocol format for direct integration with the TDC3000 system. Selection of the output form is made through the Honeywell STS103 Smart Field handheld communicator (HHC).

The instruments require a supply voltage of 10,8 V (load: 0 Ω) to 42,4 V (load: ≤1440 Ω).
The maximum static pressure for the ΔP transmitters is 210 bar.

The instruments are approved as explosion proof and intrinsically safe in Class I, Division 1, Groups A, B, C, D locations, and non-incendive for Class I, Division 2, Groups A, B, C, D locations. They are also approved for EEx ia IIC T5 and EEx d IIC T6 per CENELEC standards; and Ex N II T5 per BS 6941.
The enclosures meet the requirements of NEMA 4X (watertight) and NEMA 7 (explosion proof).
The instruments conform to the EMC Directive 89/336/EEC, industrial environment.

The operation of the instruments was demonstrated in October 1999. The evaluation was performed in the laboratories of TNO in Delft, The Netherlands, over the period January 2000 to May 2000.

A draft report was issued in June 2000.

2. MAJOR FINDINGS AND COMMENTS

These findings are summarised for ready reference and to give an overview of the evaluation. For a complete assessment of the instruments the report must be read and considered as a whole.

2.1 Instrument performance

Unless otherwise stated:

- The errors and shifts are expressed as percentages of analogue output span of 4…20 mA.
- The tests were carried out at a span of 100 mbar for STD120 and STD924 and a span of 3,5 barg for STG14L and STG94L. These spans are 10 % of the upper range limit (URL) of each transmitter.
- Span adjustments were made through the HHC without the use of pressure ('Blind' calibration).
- All measurements were carried out with the calibration settings performed by the manufacturer.

The results of the ΔP transmitter, model STD120, are described in chapter 2.1.1.
The results of the ΔP transmitter, model STD924, are described in chapter 2.1.2.
The results of the GP transmitter, model STG14L, are described in chapter 2.1.3.
The results of the GP transmitter, model STG94L, are described in chapter 2.1.4.

2.1.1 Performance of the DP transmitter, STD120

Satisfactory performance features

The instrument performed satisfactorily and within specification during the following tests.

¨ **Accuracy at spans of 100 %, 50 % and 10 % of URL**

C*urrent output:*
This function showed average errors between 0,00 % and -0,04 %.
The maximum terminal-based linearity was 0,03 %.
The maximum hysteresis was 0,02 %; the maximum repeatability was 0,01 %.
D*igital output:*
This function showed average errors between +0,01 % and -0,05 %.
The maximum terminal-based linearity was 0,02 %.
M*anual output:*
This function showed average errors between +0,02 % and -0,01 %.

¨ **Output load variations**

Variations of the output load from 10 Ω to 1440 Ω at a supply of 42,4 V had no discernible effect.
The maximum load to sustain 20 mA at 42,4 V was 1660 Ω.

¨ **Power supply variations**

Variations of the power supply voltage between 16,3 V and 42,4 V, at a load of 250 Ω, had no discernible effect. The minimum voltage to sustain 20 mA at 250 Ω was 14 V.

♦ **Ambient temperature test**

The ambient temperature was increased to +85 °C and decreased to -40 °C in steps of 20 K. Two full cycles were made. The table below shows the shifts at the extreme temperatures and at +20 °C after each part of the test.

STD120	Zero shift			Span shift		
Temperature	Current out	Digital out	Manual out	Current out	Digital out	Manual out
+85 °C	+0,04 %	+0,03 %	≤0,02 %	≤0,03 %	≤0,03 %	≤0,03 %
+20 °C (1a)	–0,04 %	–0,04 %	≤0,02 %	≤0,03 %	≤0,03 %	≤0,03 %
–40 °C	–0,13 %	–0,13 %	≤0,02 %	+0,07 %	+0,06 %	≤0,03 %
+20 °C (1b)	–0,03 %	–0,04 %	≤0,02 %	≤0,03 %	≤0,03 %	≤0,03 %
+85 °C	≤0,02 %	≤0,02 %	≤0,02 %	≤0,03 %	≤0,03 %	≤0,03 %
+20 °C (2a)	–0,08 %	–0,09 %	≤0,02 %	≤0,03 %	≤0,03 %	≤0,03 %
–40 °C	–0,19 %	–0,19 %	≤0,02 %	+0,08 %	+0,06 %	≤0,03 %
+20 °C (2b)	–0,10 %	–0,11 %	≤0,02 %	≤0,03 %	≤0,03 %	≤0,03 %

Main conclusions for the analogue output:

- Zero shift: The maximum effect was found at –40 °C, second cycle: –0,19 %.
- Span shift: The maximum effect was found at –40 °C, second cycle: +0,08 %.
- The temperature had no effect on linearity and hysteresis.

¨ **Static pressure**

The span of the ΔP transmitter was set to 200 mbar (20 % of URL) for this test.
The zero shift at a static pressure of 200 bar was -0,04 %.
The span shift at a static pressure of 200 bar was -0,19 %.
The remaining shifts after the test were ≤0,03 %.

¨ **Hosedown test**

The test for Class IP x6 showed no ingress of water.

Performance outside specification

None of the tests showed instrument performance outside specification.
Some remaining zero shift was found after the temperature test.

Aspects of unspecified performance

In the following tests, where the instrument performance was not specified, the following results were obtained.

¨ **Dead band at spans of 100 % URL, 50 % URL and 10 % URL**

The maximum dead band, measured at the current output, was: 0,01 %.

¨ **Common mode interference**

A common mode voltage of 250 Vac, 50 Hz, between earth and an output terminal caused a 50 Hz ripple of 3 % peak-to-peak; no d.c. shift was found.
A common mode voltage of 50 Vdc had no effect.

¨ **Power supply interruptions**

Before the test the output was adjusted to 20 mA. After an interruption of 500 ms the output went successively to 105 % for 0,1 s; to 100 % for 1,5 s, and then, via a dip at 0 %, to the initial value within 0,4 s. The total recovery time was 2,2 s.

¨ **Power supply depressions**

The output was adjusted to 20 mA. The load was 600 Ω. The supply voltage of 24 V was depressed for maximum 500 ms. No effect was observed at supply voltages down to 12 V and, if shorter than 8 ms, neither down to 7 V. In all other cases the depression caused an instrument reset and recovery as described under Power supply interruption.

¨ **Earthing**

Earthing of the output lines had no effect.

¨ **Ambient humidity test**

Test: IEC-68-2-3: At 95 % relative humidity and +40 °C during 4 days, the zero shift was +0,05 %. There was no span shift. After the test, the zero shift was ≤0,02 % and the span shift was +0,04 %.
Test IEC-68-2-30: An increase of the ambient temperature from 25 °C to 40 °C at 95 % relative humidity caused a zero shift of +0,04 %. There was no span shift. After the test, the zero shift was ≤0,02 % and the span shift was ≤0,03 %.

¨ **One sided heat radiation**

Heat radiation with an intensity of 1000 W/m² on the positive chamber caused a maximum shift of -0,09 % at 0 % input and -0,07 % at 100 % input. On the negative chamber it caused a maximum shift of -0,06 % at 0 % input and -0,04 % at 100 % input.

¨ **Mounting position**

Tilting the instrument only caused zero shifts:

- perpendicular to the diaphragm: ±0,51 % at angles of ±10° and ±2,9 % at angles of ±90°.
- in the plane of the diaphragm: ≤0,02 % at angles of ±10° and ±0,11 % at angles of ±90°.

¨ **Vibration**

The test for each of the three main directions of the instruments consisted of a resonance search in the frequency range of 10...500 Hz. The acceleration was 1 g with a maximum amplitude of 0,07 mm. The instrument was mounted on the vibration table with the angle mounting bracket.
In the vertical direction, the resonant frequencies of the electronics housing were 27 Hz (gain: 12) and 158 Hz (gain: 5). In the two horizontal directions, the resonant frequencies were 45 Hz (gain: 22) and 27 Hz (gain: 41). The instrument operated correctly during the test. The maximum shift of the output was 0,4 % at 44 Hz horizontal vibration. No remaining span shift was found after the test.

¨ **Overranging**

The instrument was overranged by 210 bar for 1 minute. When applied to the H-side, the output current was 20,8 mA (105 %), the instrument's display showed alternating 200 % and O–L and the HHC showed the non-critical status condition by the symbol '#' as last character of the tag number. A final zero shift of +0,22 % was found after 5 minutes recovery time.
When applied to the L-side, the output current was 3,80 mA (-1,25 %), the instrument's display showed alternating -200 % and O–L and the HHC showed the symbol '#' again. A final zero shift of -0,44 % was found after 5 minutes recovery time.
Span shifts were not found after both tests.

¨ **Start-up drift**

The shifts between 5 minutes and 1 hour after start-up were ≤0,02 %.

¨ **Long term drift / Accelerated life test**

The test consisted of two periods of ten days for the Long term drift with a steady state input of 100 % and two periods of ten days for the Accelerated life test at 1 Hz with inputs between 25 % and 75 %. The output at zero input shifted ≤0,02 %. The output at 100 % input shifted ≤0,02 %.
See also the manufacturer's comments, #1.

¨ **Step response time**

The settling times with a tolerance of 1 % of span at zero damping were:
- 0,62 s to 0,64 s after an input step of 10 %.
- 0,80 s to 0,88 s after an input step of 90 %.

¨ **Frequency response**

Sinusoidal input signals with a peak-to-peak amplitude equal to 10 % of span were applied at a span of 1000 mbar (100 % of URL). The damping was zero.
The relative gain was 0,7 at 1,07 Hz. The phase lag was 45° at 0,32 Hz.

¨ **Supply reversal**

Reversal of the supply leads, 24 V, at the instrument's terminals caused a current of <10 µA without damage.

¨ **Effect of long wires**

A multi-wire cable, DRACODA 9100, with a length of 1000 m, did not influence the communication between the HHC and the transmitter.

¨ **Final accuracy**

The output was re-zeroed and the span was adjusted to 100 % of URL, 50 % of URL and 10 % of URL. The shifts of the final output span with respect to the initial output span were ≤0,03 %, ≤0,03 % and -0,04 % respectively. The values for maximum hysteresis and maximum repeatability were equal to the values found at the initial test.
The manual output showed no shift.

A g g r a v a t e d t e s t s, STD120

¨ **Differential temperature**

In air, the sensor was heated up to +80 °C and to +110 °C while the electronics remained at +20 °C. The zero shifts were +0,81 % and +1,28 % respectively. The span shifts were -0,45 % and -0,65 % respectively.

¨ **Static pressure cycling**

The static pressure was varied between 56 bar and 84 bar for 100.000 cycles at zero input. The zero shift after the test was ≤0,02 %; the span shift after the test was ≤0,03 %.

¨ **Vibration/Endurance test**

The test for each of the three main directions of the instrument consisted of a resonance search in the frequency range of 5...500 Hz followed by an Endurance test of 30 minutes at the lowest main resonance frequency. The acceleration was 3 g with a maximum amplitude of 3,17 mm. The instrument was mounted on the vibration table with the angle mounting bracket.
In the vertical direction, the resonant frequencies of the electronics housing were 22 Hz (gain: 2) and 154 Hz (gain: 3). In the two horizontal directions, the resonant frequencies were 23 Hz, (gain: 4,7), 38 Hz (gain: 8,8), 100 Hz (gain: 2,5) and 257 Hz (gain: 5,7). During the tests, the instrument operated correctly. The maximum shift of the output was 1,5 %, found at 39…43 Hz of horizontal vibration.
The Endurance tests showed fractures of the bracket within some minutes of vibration at the lowest resonance frequency for each direction. No remaining span shift was found after the test.

¨ **Humidity/Temperature cycling**

The ambient temperature varied between +10 °C and +50 °C at 95 % relative humidity for 6 cycles of 16 h. The input was 50 % during the test. The output varied ±0,08 %.

¨ **Transportation test**

The packed instrument was subjected to a vertical vibration with an acceleration of 1,1 g. for 3 hours. Then, they were dropped 10 times on edges, corners, etc. from a height of 1 m.
The test did not damage the instrument. The plastic binding of the manual was damaged. There was no span shift after the test.

¨ **Salt spray test**

The instrument was subjected to a 5 % salt spray for 200 hours at 35 °C. The salt spray caused:
- severe rust on the bolts and nuts of the pressure heads,
- loosening of the black characters on the identification shields,
- sporadic blistering of the epoxy coating on the electronics housing near cap, maximum diameter: 8 mm.

See also the manufacturer's comments, #2.

2.1.2 Performance of the ΔP transmitter, STD924

Satisfactory performance features

The instrument performed satisfactorily and within specification during the following tests.

¨ **Accuracy at spans of 100 %, 50 % and 10 % of URL**

***C**urrent output:*

This function showed average errors between +0,01 % and -0,09 %.

The maximum terminal-based linearity was 0,04 %.

The maximum hysteresis was 0,02 %; the maximum repeatability was 0,01 %.

***D**igital output:*

This function showed average errors between +0,01 % and -0,10 %.

The maximum terminal-based linearity was 0,02 %.

***M**anual output:*

This function showed average errors between +0,03 % and -0,01 %.

¨ **Ambient temperature test**

The ambient temperature was increased to +85 °C and decreased to -40 °C in steps of 20 K. Two full cycles were made. The table below shows the shifts at the extreme temperatures and at +20 °C after each part of the test.

STD924	Zero shift			Span shift		
Temperature	Current out	Digital out	Manual out	Current out	Digital out	Manual out
+85 °C	–0,10 %	–0,11 %	≤0,02 %	+0,22 %	+0,19 %	≤0,03 %
+20 °C (1a)	–0,09 %	–0,09 %	≤0,02 %	≤0,03 %	≤0,03 %	≤0,03 %
–40 °C	–0,04 %	–0,03 %	≤0,02 %	+0,32 %	+0,27 %	+0,04 %
+20 °C (1b)	–0,13 %	–0,13 %	≤0,02 %	≤0,03 %	≤0,03 %	≤0,03 %
+85 °C	–0,09 %	–0,11 %	≤0,02 %	+0,22 %	+0,20 %	≤0,03 %
+20 °C (2a)	–0,12 %	–0,12 %	≤0,02 %	≤0,03 %	≤0,03 %	≤0,03 %
–40 °C	–0,05 %	–0,05 %	≤0,02 %	+0,32 %	+0,27 %	+0,04 %
+20 °C (2b)	–0,14 %	–0,14 %	≤0,02 %	≤0,03 %	≤0,03 %	≤0,03 %

Main conclusions for the analogue output:

- Zero shift: The maximum effect was found after the test: –0,14 %.
- Span shift: The maximum effect was found at –40 °C, both cycles: +0,32 %.
- The temperature had no effect on linearity and hysteresis.

¨ **Static pressure**

The span of the ΔP transmitter was set to 200 mbar (20 % of URL) for this test.

The zero shift at a static pressure of 200 bar was +0,06 %.

The span shift at a static pressure of 200 bar was -0,23 %.

The remaining shifts after the test were ≤0,03 %.

Performance outside specification

None of the tests showed instrument performance outside specification.
Some remaining zero shift was found after the temperature test.

Aspects of unspecified performance

In the following tests, where the instrument performance was not specified, the following results were obtained.

- **Dead band at spans of 100 % URL, 50 % URL and 10 % URL**

The maximum dead band, measured at the current output, was: 0,01 %.

- **One sided heat radiation**

Heat radiation with an intensity of 1000 W/m² on the positive chamber caused a maximum shift of -0,04 % at 0 % input and +0,07 % at 100 % input. On the negative chamber it caused a maximum shift of -0,08 % at 0 % input and -0,05 % at 100 % input.

- **Start-up drift**

The shifts between 5 minutes and 1 hour after start-up were +0,04 % and +0,08 % for 0 % input and 100 % input respectively.

- **Long term drift / Accelerated life test**

The test consisted of two periods of ten days for the Long term drift with a steady state input of 100 % and two periods of ten days for the Accelerated life test at 1 Hz with inputs between 25 % and 75 %. The output at zero input shifted ≤0,02 %. The output at 100 % input shifted ≤0,02 %.
See also manufacturer's comments, #1.

- **Final accuracy**

The output was re-zeroed and the span was adjusted to 100 % of URL, 50 % of URL and 10 % of URL. The shifts of the final output span with respect to the initial output span were ≤0,03 %, ≤0,03 % and -0,04 % respectively. The values for maximum hysteresis and maximum repeatability were equal to the values found at the initial test.
The manual output showed no shift.

Aggravated tests, STD924

- **Differential temperature**

In air, the sensor was heated up to +80 °C and to +110 °C while the electronics remained at +20 °C. The zero shifts were +0,29 % and +0,65 % respectively. The span shifts were -0,49 % and -0,49 % respectively.

- **Static pressure cycling**

The static pressure was varied between 56 bar and 84 bar for 100.000 cycles at zero input. The zero shift after the test was +0,09 %; the span shift after the test was +0,07 %.

2.1.3 Performance of the GP transmitter, STG14L

Satisfactory performance features

The instrument performed satisfactorily and within specification during the following tests.

¨ **Accuracy at spans of 100 %, 50 % and 10 % of URL**

C*urrent output:*

This function showed average errors between 0,00 % and -0,03 %.

The maximum terminal-based linearity was 0,02 %.

The maximum hysteresis was 0,02 %; the maximum repeatability was 0,01 %.

D*igital output:*

This function showed average errors between +0,01 % and -0,04 %.

The maximum terminal-based linearity was 0,01 %.

M*anual output:*

This function showed average errors between +0,01 % and -0,02 %.

¨ **Ambient temperature test**

The ambient temperature was increased to +85 °C and decreased to –40 °C in steps of 20 K. Two full cycles were made. The table below shows the shifts at the extreme temperatures and at +20 °C after each part of the test.

STG14L	Zero shift			Span shift		
Temperature	Current out	Digital out	Manual out	Current out	Digital out	Manual out
+85 °C	–0,06 %	–0,06 %	≤0,02 %	–0,08 %	–0,07 %	≤0,03 %
+20 °C (1a)	–0,06 %	–0,05 %	≤0,02 %	≤0,03 %	≤0,03 %	≤0,03 %
–40 °C	–0,04 %	≤0,02 %	≤0,02 %	+0,07 %	+0,06 %	≤0,03 %
+20 °C (1b)	≤0,02 %	≤0,02 %	≤0,02 %	≤0,03 %	≤0,03 %	≤0,03 %
+85 °C	–0,05 %	–0,05 %	≤0,02 %	–0,08 %	–0,08 %	≤0,03 %
+20 °C (2a)	–0,06 %	–0,06 %	≤0,02 %	≤0,03 %	≤0,03 %	≤0,03 %
–40 °C	–0,04 %	–0,03 %	≤0,02 %	+0,07 %	+0,08 %	≤0,03 %
+20 °C (2b)	–0,03 %	≤0,02 %	≤0,02 %	≤0,03 %	≤0,03 %	≤0,03 %

Main conclusions for the analogue output:

- Zero shift: The maximum effect was –0,06 %.
- Span shift: The maximum effect was found at +85 °C, both cycles: –0,08 %.
- The temperature had no effect on linearity and hysteresis.

Performance outside specification

None of the tests showed instrument performance outside specification.

Aspects of unspecified performance

In the following tests, where the instrument performance was not specified, the following results were obtained.

¨ **Dead band at spans of 100 % URL, 50 % URL and 10 % URL**

The maximum dead band, measured at the current output, was: 0,01 %.

¨ **Mounting position**

Tilting the instrument over angles of ±10° had no effect.
Tilting the instrument over angles of ±90° caused a maximum zero shift of ±0,07 %. There was no span shift.

¨ **Vibration**

The test for each of the three main directions of the instruments consisted of a resonance search in the frequency range of 10...500 Hz. The acceleration was 1 g with a maximum amplitude of 0,07 mm. The instrument was mounted on the vibration table with a male-male connector.
In the vertical direction, no resonant frequency was found. In the two horizontal directions, the resonant frequencies of the electronics housing were 83 Hz (gain: 20) and 93 Hz (gain: 24). The instrument operated correctly during the test. Shifts of the output were not found during the tests. No remaining span shift was found after the test.

¨ **Overranging**

The instrument was overranged by 50 bar for 1 minute. During the test, the output current was 20,8 mA (105 %), the instrument's display showed alternating 200 % and O–L and the HHC showed 200,00 %. No remaining shifts were found after the test.

¨ **Long term drift**

The input was kept constant at 90 % over 30 days. The output varied between –0,02 % and +0,01 %. *See also the manufacturer's comments, #1.*

¨ **Step response time**

The settling times with a tolerance of 1 % of span at zero damping were:
- 0,50 s to 0,54 s after an input step of 10 %.
- 0,74 s to 0,80 s after an input step of 90 %.

¨ **Frequency response**

Sinusoidal input signals with a peak-to-peak amplitude equal to 10 % of span were applied. The damping was zero.
The relative gain was 0,7 at 1,2 Hz. The phase lag was 45° at 0,40 Hz.

¨ **Final accuracy**

The test was not carried out for this instrument as the instrument became defect during the aggravated Vibration/Endurance test.

A g g r a v a t e d t e s t s, STG14L

¨ **Differential temperature**

In air, the sensor was heated up to +80 °C and to +110 °C while the electronics remained at +20 °C. The zero shifts were +0,07 % and +0,10 % respectively. The span shifts were -0,43 % and -0,56 % respectively.

¨ **Vibration/Endurance test**

The test for each of the three main directions of the instrument consisted of a resonance search in the frequency range of 5...500 Hz followed by an Endurance test of 30 minutes at the lowest main resonance frequency. The acceleration was 3 g with a maximum amplitude of 3,17 mm. The instrument was mounted on the vibration table with a male-male connector.
In the vertical direction, no resonant frequencies were found. In the first horizontal direction, the resonant frequency of the electronics housing was 82 Hz (gain: 22).
The Endurance test, horizontal vibration, damaged the electronics after 28 minutes. The output increased to 21 mA permanently. The display showed – – – and a '#' sign. The status was: Invalid database. *See also the manufacturer's comments, #3.*

2.1.4 Performance of the GP transmitter, STG94L

S a t i s f a c t o r y p e r f o r m a n c e f e a t u r e s

The instrument performed satisfactorily and within specification during the following tests.

¨ **Accuracy at spans of 100 %, 50 % and 10 % of URL**

C*urrent output:*
This function showed average errors between +0,02 % and -0,03 %.
The maximum terminal-based linearity was 0,02 %.
The maximum hysteresis was 0,01 %; the maximum repeatability was 0,01 %.
D*igital output:*
This function showed average errors between +0,01 % and -0,04 %.
The maximum terminal-based linearity was 0,01 %.
M*anual output:*
This function showed average errors between +0,01 % and -0,02 %.

¨ **Ambient temperature test**

The ambient temperature was increased to +85 °C and decreased to –40 °C in steps of 20 K. Two full cycles were made. The table below shows the shifts at the extreme temperatures and at +20 °C after each part of the test.

STG94L	Zero shift			Span shift		
Temperature	Current out	Digital out	Manual out	Current out	Digital out	Manual out
+85 °C	+0,10 %	+0,08 %	≤0,02 %	≤0,03 %	≤0,03 %	≤0,03 %
+20 °C (1a)	≤0,02 %	–0,03 %	≤0,02 %	≤0,03 %	≤0,03 %	≤0,03 %
–40 °C	≤0,02 %	≤0,02 %	≤0,02 %	+0,24 %	+0,20 %	+0,04 %
+20 °C (1b)	≤0,02 %	≤0,02 %	≤0,02 %	≤0,03 %	≤0,03 %	≤0,03 %
+85 °C	+0,10 %	+0,07 %	≤0,02 %	+0,04 %	≤0,03 %	≤0,03 %
+20 °C (2a)	≤0,02 %	–0,03 %	≤0,02 %	≤0,03 %	≤0,03 %	≤0,03 %
–40 °C	≤0,02 %	≤0,02 %	≤0,02 %	+0,25 %	+0,22 %	+0,06 %
+20 °C (2b)	≤0,02 %	≤0,02 %	≤0,02 %	≤0,03 %	≤0,03 %	≤0,03 %

Main conclusions for the analogue output:
- Zero shift: The maximum effect was found at +85 °C, both cycles: +0,10 %.
- Span shift: The maximum effect was found at –40 °C, second cycle: +0,25 %.
- The temperature had no effect on linearity and hysteresis.

Performance outside specification

None of the tests showed instrument performance outside specification.

Aspects of unspecified performance

In the following tests, where the instrument performance was not specified, the following results were obtained.

¨ **Dead band at spans of 100 % URL, 50 % URL and 10 % URL**

The maximum dead band, measured at the current output, was: 0,01 %.

¨ **Long term drift**

The input was kept constant at 90 % over 30 days. The output varied between 0,00 % and +0,02 %. *See also the manufacturer's comments, #1.*

¨ **Final accuracy**

The output was re-zeroed and the span was adjusted to 100 % of URL, 50 % of URL and 10 % of URL. The shifts of the final output span with respect to the initial output span were ≤0,03 %, -0,04 % and ≤0,03 % respectively. The values for maximum hysteresis and maximum repeatability were equal to the values found at the initial test.
The manual output showed no shift.

Aggravated tests, STG94L

¨ **Differential temperature**

In air, the sensor was heated up to +80 °C and to +110 °C while the electronics remained at +20 °C. The zero shifts were +0,14 % and +0,28 % respectively. The span shifts were -0,48 % and -0,70 % respectively. After the test, no shifts were found.

2.1.5 Unexpected events

No defects and no unexpected events occurred during the evaluation.

2.2 Comments on construction and use

The vibration test showed that:
- The mounting bracket, angle type, was not rigid enough for the ΔP transmitter,
- The mounting studs for the PCB with electronics and display unit were not rigid enough.

See also the manufacturer's comments, #3.

The temperature of the sensor body could be read on the HHC. The STD120, STG14L and STG94L showed maximum errors of ±4 K at sensor temperatures of -40 °C…+85 °C. The STD924 showed maximum errors of –4 K and +3 K at +20 °C…+85 °C and a maximum error of +18 K at -40 °C…+20 °C. The manual specified a maximum error of 5 K.

The LCD of the instrument's local smart meter showed no information at -40 °C ambient temperature. The LCD response time was reduced at -20 °C ambient temperature.

The Local Smart Meter unit has eight buttons. They could be used for fine adjustment of zero and span with live pressure and selection of the engineering units. The button **VAR SEL** caused a message Er2 on the display. This button has no function. For local operation, the cap should be removed. For full access to the instrument the HHC was necessary.

The update rate of the current output was 0,12 s.
The update rate of data on the local display unit was 0,6 s.
The update rate of the input value on the HHC was 6 s.
The update rate of the output value on the HHC was 10 s.
The update rate of the sensor temperature on the HHC was 7,5 s.
Update rates on the HHC are specified as 6 s.

A load resistance of at least 163 Ω in the supply leads was required for operation of the HHC at a supply voltage of 24 V. Connection of the HHC on the output lines had no discernible effect on the output current.

There is no automatic switch-off function for the HHC. The operation time for a fully recharged battery is specified as 24 hours. The recharge time for the battery is specified as 16 hours.

The default fail save direction is upscale. Changing it to downscale must be done at the back of the instrument's PCB.

2.3 Comments on documentation and identification

Documentation

Each instrument was delivered with User's Manual and a Calibration Test Report. Data sheets were received separately at the start of the project.

The User's Manual was valid for instruments of both Series 100 and 900. It gave instructions for configuration, mounting, wiring, adjustment, installation and maintenance. A parts list was included. Attention was paid to installation in hazardous locations and freeze protection.
The manual specified conformity to the EMC Directive 89/336/EEC, industrial environment. Maximum EMC effects were not specified. The numbers of the technical construction files were not specified.

The manual included the instructions for operating the Smart Field Communicator, STS300. An overall menu tree was not included.

The manual did not include the performance specifications. These were given in the 'Specification and Model Selection Guide'. They also gave a list of optional features and ordering information.

The Calibration Test Reports gave the results of a 5-point calibration at 100 % URL and at 25 % URL for each transmitter.

Identification
The instrument was identified by two labels of stainless steel. The label on the electronics showed model code, factory calibration range, and limits for ambient temperature and limits for sensor temperature. The label on the sensor assembly showed model code, serial code, PROM number, filling fluid, materials, range limits and rating. The characters on the labels were hard to read.
An additional label on the instrument showed Eex-information for operation in hazardous areas and the CE mark.

2.4 Manufacturer's comments

Note: This section is not part of the laboratory's report.

We have reviewed your evaluation report on the representative ST 3000 differential and gauge pressure models and consider it a fair assessment of the product's performance.

We would like to add the following comments for clarification.
1. For all the models tested the time drift specification is 0,03 % of URL (Upper Range Limit) per year. This is now included in the Performance table of the Product Specification Sheets.
2. For applications where salt spray exposure is likely we offer a range of resistive material options such a 316 stainless steel enclosure, 2 part epoxy paint coating, stainless steel process head bolts etc.
3. We are grateful to WIB for highlighting the vibration resistance issue in the ST 3000 during aggravated/ maintained resonance conditions. We have analysed the failed printed wiring board and determined that the failure was one that we have previously identified through our in house test program. The circuit has been redesigned to make it more vibration resistant.

3. TEST RESULTS

Unless otherwise stated:
- Errors are quoted as a percentage of span.
- The span was adjusted to 10 % of the Upper Range Limit (URL)
- The tests were carried out at the following reference conditions:
  Ambient temperature (20 ± 2) °C
  Ambient humidity 45...75 % relative humidity
  Power supply 24 Vdc ± 1 %
  Output load 250 Ω
- Span adjustments were made through the HHC without the use of pressure ('Blind' calibration).
- All measurements were carried out with the calibration settings performed by the manufacturer.

Chapter 6 gives detailed information of the tests and the test set-ups. The uncertainties were:

ΔP, range	% URL	Uncertainty	GP, range	% URL	Uncertainty
0…1000 mbar	100 %	0,02 %	0…35 bar	100 %	0,015 %
0…500 mbar	50 %	0,03 %	0…17 bar	50 %	0,02 %
0…100 mbar	10 %	0,05 %	0…3,5 bar	10 %	0,02 %
0…200 mbar, Pstatic = 200 bar	20 %	0,05 %			

The discrimination for all measurements was 0,001 %.

3.1 Results' summary of the DP transmitter STD120

3.1.1 Standard WIB tests

Test number and subject for transmitter STD120	**Measured and observed**	**Manufacturer's specifications**
01 Accuracy test		
Current output		
Span: 100 % of URL	See graph 1.1	Accuracy,
- Max. average errors	0,00 % and –0,03 %	Terminal based:
- Max. hysteresis	0,01 %	0,075 %
- Max. repeatability	0,01 %	
- Linearity, terminal-based	0,02 %	
Span: 50 % of URL	See graph 1.2	
- Max. average errors	0,00 % and –0,03 %	
- Max. hysteresis	0,01 %	
- Max. repeatability	0,01 %	
- Linearity, terminal-based	0,02 %	

Test number and subject for transmitter STD120	**Measured and observed**	**Manufacturer's specifications**
Span: 10 % of URL - Max. average errors - Max. hysteresis - Max. repeatability - Linearity, terminal-based	See graph 1.3 0,00 % and –0,04 % 0,02 % 0,01 % 0,03 %	
Digital output Span: 100 % of URL - Max. average errors - Max. hysteresis - Max. repeatability - Linearity, terminal-based	See graph 1.1 0,00 % and –0,05 % 0,01 % 0,01 % 0,01 %	Accuracy, Terminal based: 0,0625 %
Span: 50 % of URL - Max. average errors - Max. hysteresis - Max. repeatability - Linearity, terminal-based	See graph 1.2 0,00 % and –0,05 % 0,01 % 0,01 % 0,02 %	
Span: 10 % of URL - Max. average errors - Max. hysteresis - Max. repeatability - Linearity, terminal-based	See graph 1.3 +0,01 % and –0,05 % 0,02 % 0,01 % 0,02 %	
Manual output - Max. average errors - Max. hysteresis - Max. repeatability	See graph 1.4 +0,02 % and –0,01 % <0,01 % <0,01 %	
General - Minimum current output - Maximum current output - Output update rate	 3,80 mA (–1,25 %) 20,76 mA (104,8 %) 0,12 s	
02 Dead band Span: 100 % of URL Span: 50 % of URL Span: 10 % of URL	 0,01 % 0,01 % 0,01 %	
03 Output load variations Supply: 42,4 V Load between 10 Ω and 1440 Ω - Effect - Maximum load to sustain 20 mA	 No discernible effect. 1660 Ω	 0,14 %

Test number and subject for transmitter STD120	Measured and observed	Manufacturer's specifications
04 Common mode interference 250 Vac, between earth and + terminal, effect – terminal, effect ±50 Vdc, between earth and + terminal, effect – terminal, effect	 50 Hz ripple: 3 % pp, no d.c. shift 50 Hz ripple: 3 % pp, no d.c. shift No discernible effect No discernible effect	
05 Power supply variations Load 250 Ω Supply between 16,3 V and 42,4 V - Shift - Minimum voltage to sustain 20 mA	 No discernible effect 14 V	 0,13 %
06 Power supply interruptions Input: 100 %; interruption 5…500 ms - Output during interruption - Output after interruption Note	 During interruption: output: 0 mA Recovery after interruption: - Output to 105 % in 0,01 s, - Output at 105 % for 0,1 s, - Output to 100 % in 0,1 s, - Output at 100 % for 1,5 s, - Output to 4 mA in 0,1 s, - Output to final value ±1% in 0,4 s. The total recovery time was 2,2 s. Effect was equal for all interruption periods in the range 5…500 ms.	
07 Power supply depression Input 100 %, load: 600 Ω Max. duration 500 ms - Effects	 <u>Depression</u> <u>Effect</u> 24 to 12 V No effect 24 to 12…7 V, Δt <8 ms No effect 24 to 12…7 V, Δt >8 ms Reset 24 to <7 V Reset Reset means recovery as described under interruption test.	
08 Earthing - Effect	 No discernible effect	

Test number and subject for transmitter STD120	Measured and observed		Manufacturer's specifications	
09 Ambient temperature 2 cycles between +85 °C and –40 °C				
Current output Reference: +20 °C	Zero shift	Span shift	Zero	Total
- Shift at +40 °C, cycle 1	≤0,02 %	≤0,03 %	0,05 %	0,08 %
- Shift at +60 °C, cycle 1	≤0,02 %	≤0,03 %	0,11 %	0,16 %
- Shift at +85 °C, cycle 1	+0,04 %	≤0,03 %	0,17 %	0,26 %
- Shift at +20 °C, cycle 1	–0,04 %	≤0,03 %	---	---
- Shift at 0 °C, cycle 1	–0,09 %	≤0,03 %	0,05 %	0,08 %
- Shift at –20 °C, cycle 1	–0,11 %	+0,04 %	0,11 %	0,16 %
- Shift at –40 °C, cycle 1	–0,13 %	+0,07 %	0,16 %	0,24 %
- Shift at +20 °C, cycle 1	–0,03 %	≤0,03 %	---	---
- Shift at +40 °C, cycle 2	–0,03 %	≤0,03 %	0,05 %	0,08 %
- Shift at +60 °C, cycle 2	–0,04 %	≤0,03 %	0,11 %	0,16 %
- Shift at +85 °C, cycle 2	≤0,02 %	≤0,03 %	0,17 %	0,26 %
- Shift at +20 °C, cycle 2	–0,08 %	≤0,03 %	---	---
- Shift at 0 °C, cycle 2	–0,14 %	≤0,03 %	0,05 %	0,08 %
- Shift at –20 °C, cycle 2	–0,18 %	+0,06 %	0,11 %	0,16 %
- Shift at –40 °C, cycle 2	–0,19 %	+0,08 %	0,16 %	0,24 %
- Shift after the test	–0,10 %	≤0,03 %	---	---
	Graph 1.5 shows Zero shift. Graph 1.7 shows Shift at 100 %. Graph 1.9 shows Span shift.			
Temperature effect on linearity, measured at 50 % input - For all temperatures	No discernible effect			
Hysteresis at 50 % input - For all temperatures	≤0,03 %			
Digital output Reference: +20 °C	Zero shift	Span shift	Zero	Total
- Shift at +40 °C, cycle 1	≤0,02 %	≤0,03 %	0,04 %	0,06 %
- Shift at +60 °C, cycle 1	≤0,02 %	≤0,03 %	0,09 %	0,13 %
- Shift at +85 °C, cycle 1	+0,03 %	≤0,03 %	0,15 %	0,20 %
- Shift at +20 °C, cycle 1	–0,04 %	≤0,03 %	---	---
- Shift at 0 °C, cycle 1	–0,09 %	≤0,03 %	0,04 %	0,06 %
- Shift at –20 °C, cycle 1	–0,12 %	≤0,03 %	0,09 %	0,13 %
- Shift at –40 °C, cycle 1	–0,13 %	+0,06 %	0,13 %	0,19 %
- Shift at +20 °C, cycle 2	–0,04 %	≤0,03 %	---	---
- Shift at +40 °C, cycle 2	–0,03 %	≤0,03 %	0,04 %	0,06 %

Test number and subject for transmitter STD120	Measured and observed		Manufacturer's specifications	
- Shift at +60 °C, cycle 2	–0,04 %	≤0,03 %	0,09 %	0,13 %
- Shift at +85 °C, cycle 2	≤0,02 %	≤0,03 %	0,15 %	0,20 %
- Shift at +20 °C, cycle 2	–0,09 %	≤0,03 %	---	---
- Shift at 0 °C, cycle 2	–0,14 %	≤0,03 %	0,04 %	0,06 %
- Shift at –20 °C, cycle 2	–0,18 %	≤0,03 %	0,09 %	0,13 %
- Shift at –40 °C, cycle 2	–0,19 %	+0,06 %	0,13 %	0,19 %
- Shift after the test	–0,11 %	≤0,03 %	---	---
	Graph 1.6 shows Zero shift.			
	Graph 1.8 shows Shift at 100 %.			
	Graph 1.10 shows Span shift.			
Temperature effect on linearity, measured at 50 % input				
- For all temperatures	No discernible effect			
Hysteresis at 50 % input				
- For all temperatures	≤0,03 %			
Manual output				
Reference: +20 °C	Zero shift	Span shift		
- Shift at all temperatures	≤0,02 %	≤0,03 %		
Except for: Shift at –20 °C, cycle 1	≤0,02 %	+0,04 %		
Shift at –20 °C, cycle 2	≤0,02 %	+0,04 %		
- Shift after the test	≤0,02 %	≤0,03 %		
Sensor temperature Indication				
- Maximum error	At –40…+85 °C: 4 K		5 K	
	See graph 5.1			
Final six-point upscale calibration				
Max. average errors				
- Current output	–0,09 % and –0,12 %			
- Digital output	–0,09 % and –0,14 %			
	See graph 1.11			
10 Ambient humidity				
Test 1: 95 % r.h.; +40 °C; 4 days	Zero shift	Span shift	Zero	Total
- Shift during the test	+0,05 %	≤0,03 %	0,05 %	0,08 %
- Shift after the test	≤0,02 %	+0,04 %		
Test 2: Increase of temperature from				
25°C to 40 °C at 95 % r.h.	Zero shift	Span shift	Zero	Total
- Shift during the test	+0,04 %	≤0,03 %	0,05 %	0,08 %
- Shift after the test	≤0,02 %	≤0,03 %		

Test number and subject for transmitter STD120	Measured and observed		Manufacturer's specifications
11 One sided heat radiation			
1000 W/m², radiation on:	Shift at	Shift at	
H-chamber	0 % input	100 % input	
- Max. shift during radiation	–0,09 %	–0,07 %	
- Final shift during radiation	–0,07 %	–0,05 %	
- Final shift after stop radiation	+0,05 %	≤0,03 %	
L-chamber			
- Max. shift during radiation	–0,06 %	–0,04 %	
- Final shift during radiation	–0,05 %	–0,04 %	
- Final shift after stop radiation	+0,03 %	≤0,03 %	
12 Mounting position			
Tilting, perpendicular to diaphragm	Zero shift	Span shift	
- Shift at ±10°	±0,51 %	≤0,03 %	
- Shift at +90°	±2,9 %	≤0,03 %	
Tilting, in plane of diaphragm	Zero shift	Span shift	
- Shift at ±10°	≤0,02 %	≤0,03 %	
- Shift at ±90°	±0,11 %	≤0,03 %	
13 Vibration			
Max. amplitude: 0,07 mm			
Max. acceleration: 1 g			
Frequency range: 10...500 Hz			
Vertical			
- Resonance of electronics housing	27 Hz, Q = 12		
	158 Hz, Q = 5		
- Maximum shift	≤0,2 %		
Horizontal-Transversal			
- Resonance of electronics housing	45 Hz, Q = 22		
- Maximum shift	±0,4 % at 44 Hz		
Horizontal-Longitudinal			
- Resonance of electronics housing	27 Hz, Q = 41		
- Maximum shift	≤0,2 %		
Behaviour during all tests	Correct operation		
Span shift after the test	≤0,03 %		

Test number and subject for transmitter STD120	Measured and observed	Manufacturer's specifications
14 Overranging 210 bar, for 1 minute to: - H-chamber Output during overrange Display during overrange Output on HHC Shift after 5 min. recovery - L-chamber Output during overrange Display during overrange Output on HHC Shift after 5 min. recovery	 +105 % (20,8 mA) Alternating: 200 % and O – L Symbol '#' as last character of the tag number. Message: M.B.OVERLOAD Zero: +0,22 %; Span: ≤0,03 % –1,25 % (3,8 mA) Alternating: –200 % and O – L Symbol '#' as last character of the tag number. Message: M.B.OVERLOAD Zero: –0,44 %; Span: ≤0,03 %	
15 Static pressure test Span: 200 mbar (20 % of URL) - Shift at 50 bar - Shift at 100 bar - Shift at 150 bar - Shift at 200 bar - Shift at 0 bar, after the test	Zero shift / Span shift ≤0,02 % / ≤0,03 % ≤0,02 % / ≤0,03 % ≤0,02 % / –0,05 % –0,04 % / –0,19 % +0,03 % / ≤0,03 % Graph 1.12 shows Zero shift. Graph 1.13 shows Shift at 100 %. Graph 1.14 shows Span shift.	Zero / Total 0,05 % / 0,11 % 0,11 % / 0,21 % 0,16 % / 0,32 % 0,21 % / 0,43 % --- / ---
18 Start-up drift - Shift between 5 min and 1 hour after start-up	0 % input / 100 % input ≤0,02 % / ≤0,02 %	
19 Long term drift / Accelerated life test 4 tests of 10 days each: • Drift test, steady input: 100 % • Accelerated life test, 1 Hz • Drift test, steady input: 100 % • Accelerated life test, 1 Hz		0,3 % per year

Test number and subject for transmitter STD120	Measured and observed	Manufacturer's specifications
Shift: - after 10 days - after 20 days - after 30 days - after 40 days Drift of the output at 100 % input	Zero shift / Span shift ≤0,02 % / ≤0,03 % ≤0,02 % / ≤0,03 % ≤0,02 % / ≤0,03 % ≤0,02 % / ≤0,03 % Between: 0,00 % and +0,02 %	
23 Step response time Damping: zero - Input: 45 % ↔ 55 % - Input: 10 % ↔ 90 %	Settling time for 1 % tolerance: Up / Down 0,64 s / 0,62 s 0,88 s / 0,80 s	
24 Frequency response Span: 100 % of URL Damping: zero Amplitude: 10 % peak-to-peak - Relative gain - The gain reduced to 0,7 at - The phase lag was 45° at	 Bode diagram: Graph 1.16 1,07 Hz 0,32 Hz	
25 Supply reversal - Effect during reversal - Remaining effect	 No operation, current <10 µA No remaining effect	
26 Effect of long wires 1000 m of multi-wire cable, DRACODA 9100, between instrument and HHC - Effect on communication via HHC	 No effect	
29 Final accuracy *Current output* Shift of the final output span with respect to the initial output span Span: 100 % of URL, span shift Span: 50 % of URL, span shift Span: 10 % of URL, span shift Increase of hysteresis All spans Increase of repeatability All spans	 ≤0,03 % ≤0,03 % –0,04 % ≤0,01 % ≤0,01 %	
Manual output Shift of the manual output Zero shift Span shift	 ≤0,02 % ≤0,03 %	

3.1.2 Aggravated tests

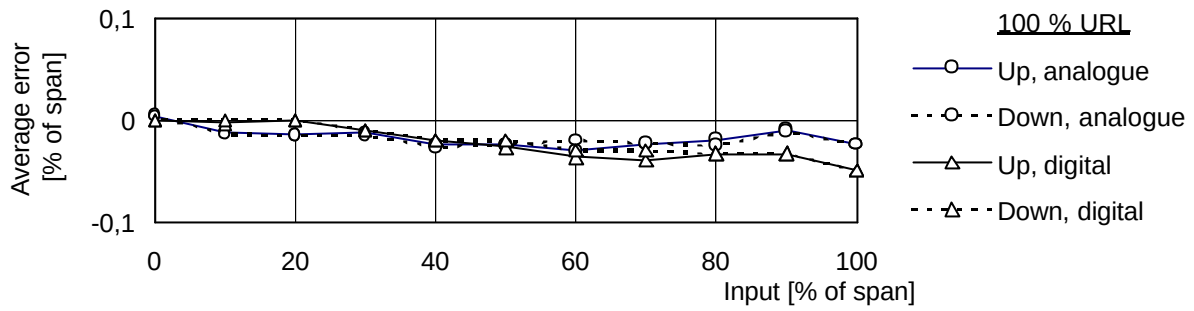
Test number and subject for transmitter STD120	Measured and observed	Manufacturer's specifications
31 Differential temperatures		
Electronics at 20 °C	Zero shift / Span shift	
- Shift, when sensor at 80 °C	+0,81 % / –0,45 %	
- Shift, when sensor at 110 °C	+1,28 % / –0,65 %	
- Shift after the test	≤0,02 % / ≤0,03 %	
32 Static pressure cycling		
Static pressure variations: 56…84 bar, 100.000 cycles		
- Zero shift after 25.000 cycles	≤0,02 %	
- Zero shift after 50.000 cycles	≤0,02 %	
- Zero shift after 75.000 cycles	≤0,02 %	
- Zero shift after 100.000 cycles	≤0,02 %	
- Span shift after 100.000 cycles	≤0,03 %	
33 Vibration / Endurance test		
Maximum amplitude: 3,17 mm Maximum acceleration: 3 g Frequency range: 5…500 Hz For each of the 3 main directions:		
- Resonance search		
- Shift during resonance search		
- Endurance test: 30 min at the lowest main resonance frequency		
Vertical		
- Resonance of electronics housing	22 Hz, Q = 2,0 154 Hz, Q = 3,0	
- Maximum shift	0,4 % at 40 Hz 0,2 % at 84 Hz 0,4 % at 150 Hz	
Endurance test, effects	- Fracture of mounting bracket after 2 minutes at 23 Hz. - Test restarted with a new bracket. This also broke within 2 minutes. - Test stopped.	

Test number and subject for transmitter STD120	Measured and observed	Manufacturer's specifications
Horizontal – Transversal - Resonance of electronics housing - Maximum shift - Endurance test, effects *Horizontal – Longitudinal* - Resonance of electronics housing - Maximum shift - Endurance test, effects Span shift after the test	 38 Hz, Q = 8,8 100 Hz, Q = 2,5 275 Hz, Q = 5,7 1,5 % at 39…43 Hz Fracture of mounting bracket after 4 minutes at 38 Hz. Test stopped. 23 Hz, Q = 4,7 ≤0,2 % Fracture of mounting bracket after 1 minute at 23 Hz. Test stopped. ≤0,03 %	
34 Humidity / Temperature cycling Cycling between +10 °C and +50 °C at 95 % r.h., 6 cycles of 16 hours Drift of the output at 50 % input Remaining effect - Shift after the test	 The peak-to-peak variation of the output was 0,15 %. <u>Zero shift</u> <u>Span shift</u> +0,03 % ≤0,03 %	
35 Transportation test Reference: CES 288:52 1. Vibration, 1,1 g for 3 h 2. Ten drops on corners, edges, etc. Span shift after the test Damage - Instrument - Manual - Polystyrene covers - Carton	 ≤0,03 % No damage. Heavy damage of the plastic binding Heavy damage No tear of the carton.	
36 Hosedown test Test: IPx6 Ingress of water	 No ingress of water	 NEMA 4X (watertight)

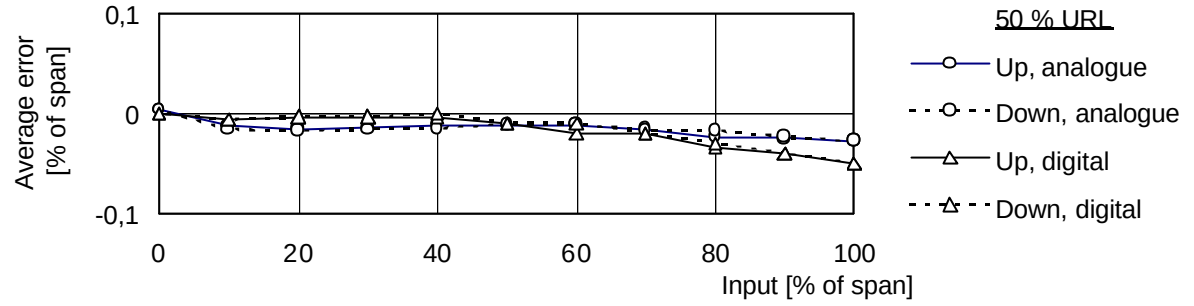
Test number and subject for transmitter STD120	Measured and observed	Manufacturer's specifications
37 Salt spray Ref: NEMA ICS 6-110.58 (1978) 200 hours, 35 °C, continuous spray - Affection	- Bolts and nuts of the pressure heads showed very severe rust. - Black characters on identification shields loosened. - Sporadic blistering of the epoxy coating on the electronics housing near cap, max. diameter: 8 mm.	*See also the manufacturer's comments, #2.*

3.1.3 Graphs for STD120

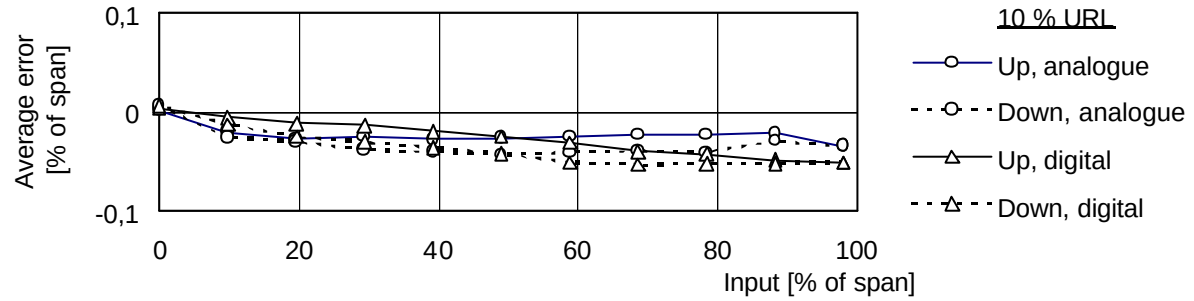
See the next pages.



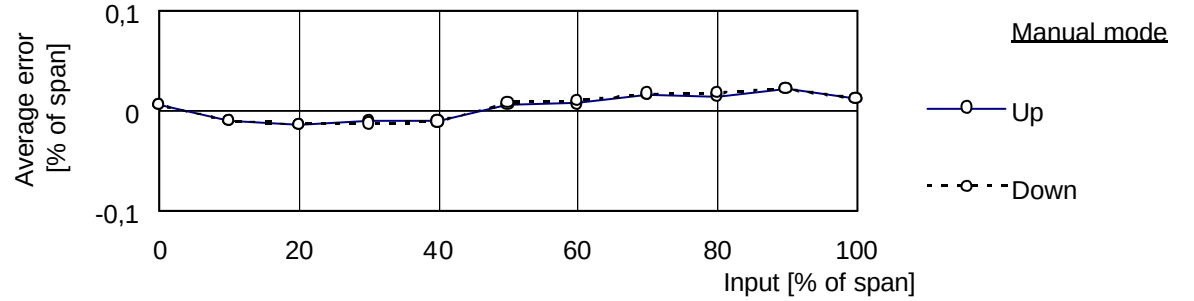
Graph 1.1 Accuracy STD120, span: 100 % URL



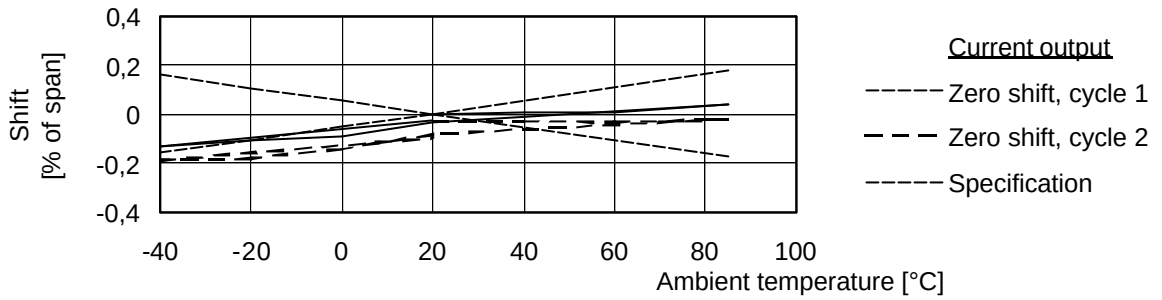
Graph 1.2 Accuracy STD120, span: 50 % URL



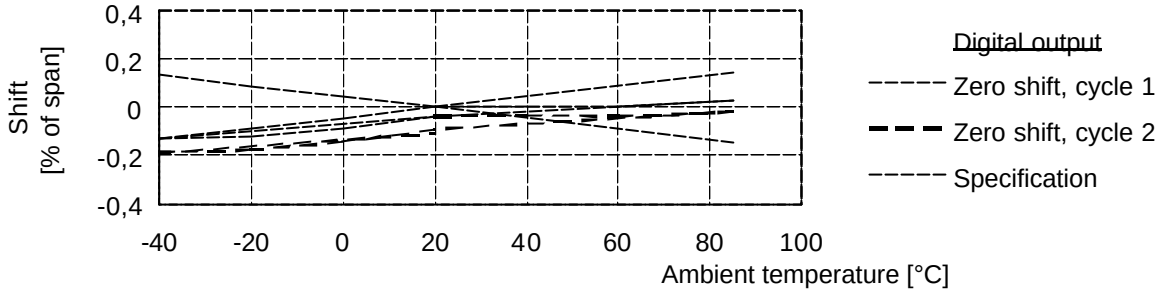
Graph 1.3 Accuracy STD120, span: 10 % URL



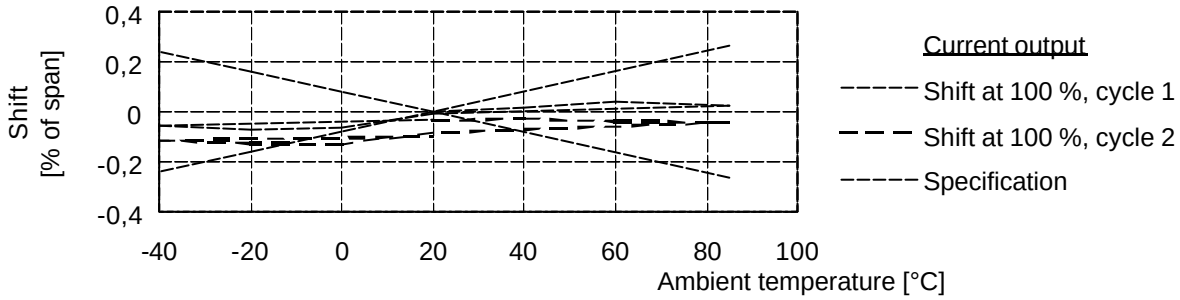
Graph 1.4 Accuracy STD120, manual mode



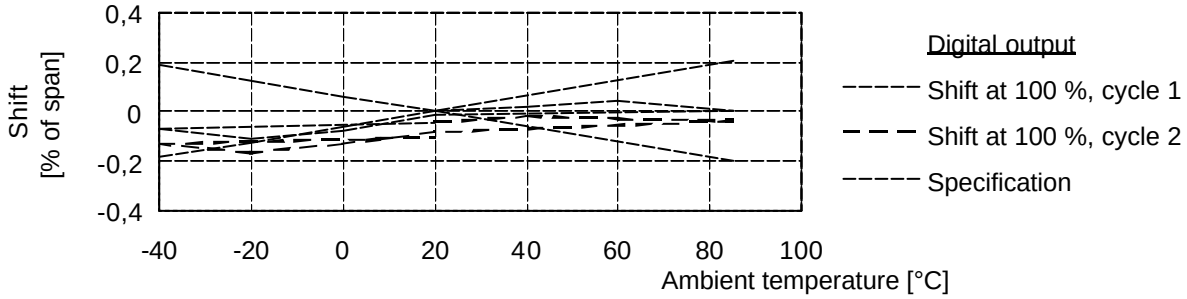
Graph 1.5 Temperature effect STD120: Zero shift of current output



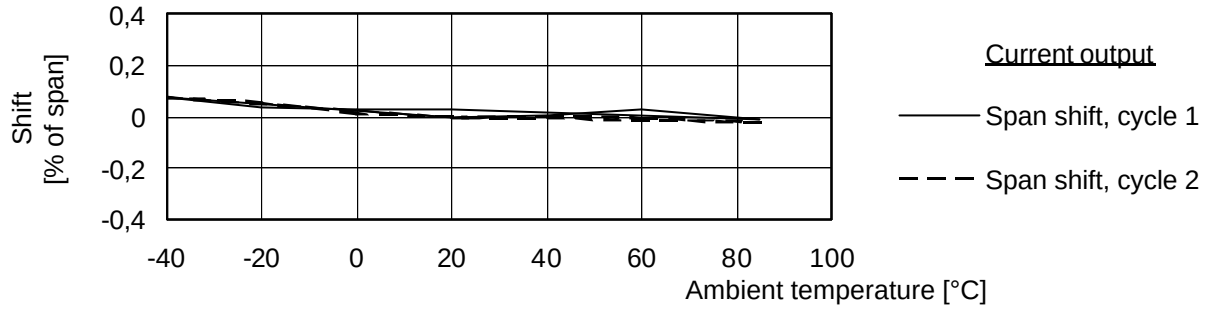
Graph 1.6 Temperature effect STD120: Zero shift of digital output



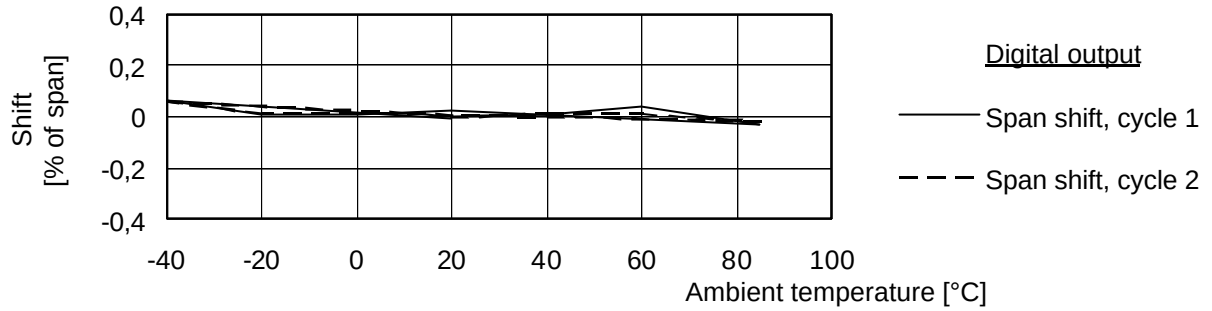
Graph 1.7 Temperature effect STD120: Shift of current output at 100 % input



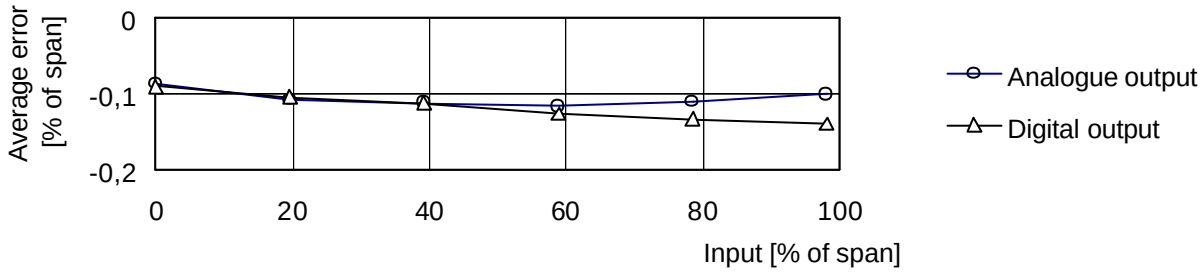
Graph 1.8 Temperature effect STD120: Shift of digital output at 100 % input



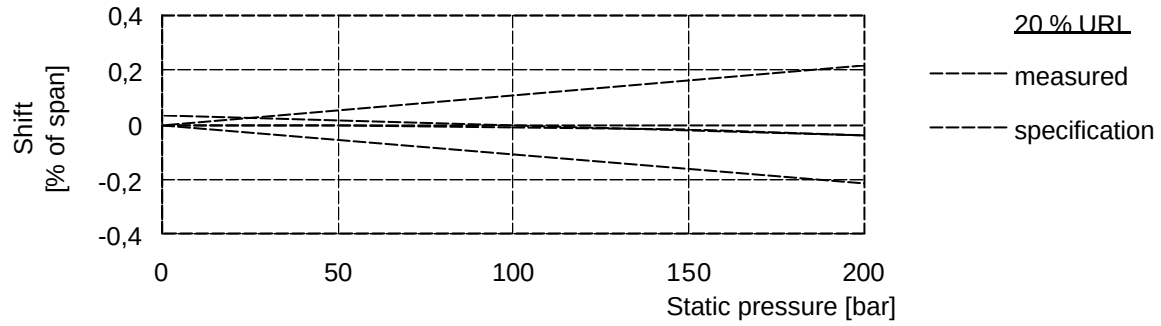
Graph 1.9 Temperature effect STD120: Span shift of current output



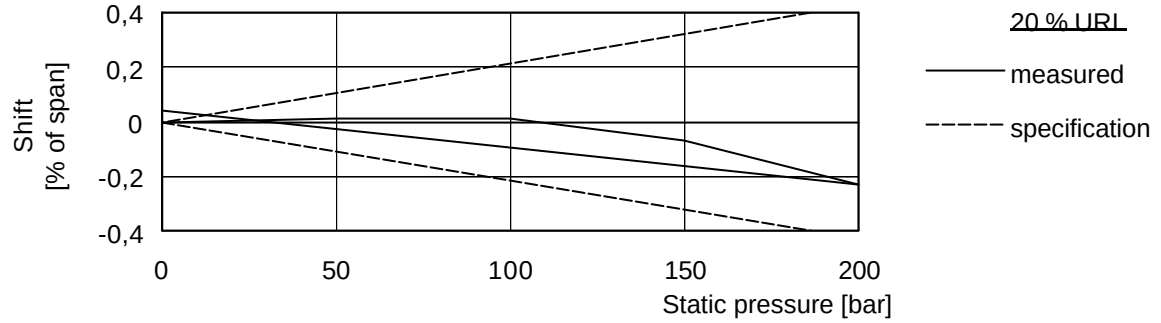
Graph 1.10 Temperature effect STD120: Span shift of digital output



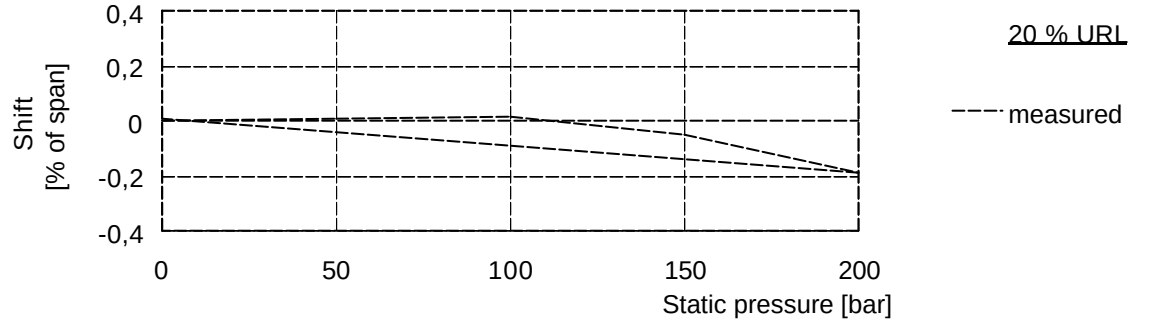
Graph 1.11 Accuracy STD120 after the temperature test



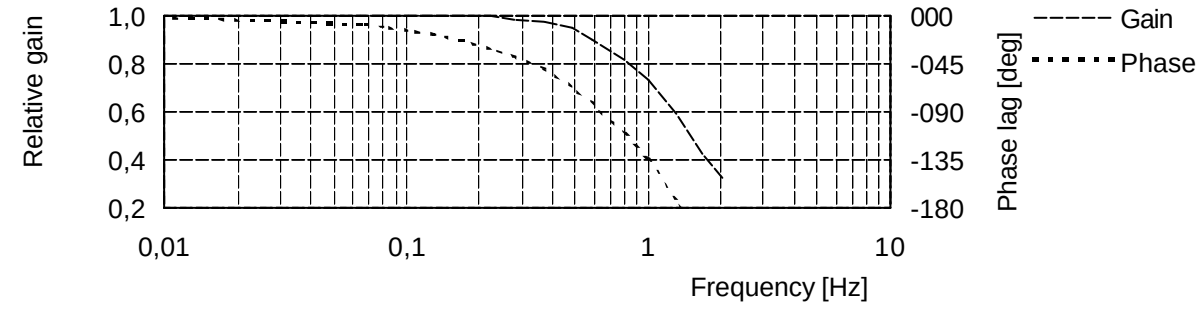
Graph 1.12 Static pressure effect STD120: Zero shift



Graph 1.13 Static pressure effect STD120: Shift at 100 % input



Graph 1.14 Static pressure effect STD120: Span shift



Graph 1.15 Bode diagram STD120

3.2 Results' summary of the DP transmitter STD924

3.2.1 Standard WIB tests

Test number and subject for transmitter STD924	Measured and observed	Manufacturer's specifications
01 Accuracy test		
Current output		
Span: 100 % of URL	See graph 2.1	Accuracy,
- Max. average errors	0,00 % and –0,03 %	Terminal based:
- Max. hysteresis	0,01 %	0,1 %
- Max. repeatability	0,01 %	
- Linearity, terminal-based	0,02 %	
Span: 50 % of URL	See graph 2.2	
- Max. average errors	0,00 % and –0,03 %	
- Max. hysteresis	0,01 %	
- Max. repeatability	0,01 %	
- Linearity, terminal-based	0,03 %	
Span: 10 % of URL	See graph 2.3	
- Max. average errors	+0,01 % and –0,09 %	
- Max. hysteresis	0,02 %	
- Max. repeatability	0,01 %	
- Linearity, terminal-based	0,04 %	
Digital output		
Span: 100 % of URL	See graph 2.1	Accuracy,
- Max. average errors	0,01 % and –0,05 %	Terminal based:
- Max. hysteresis	0,02 %	0,075 %
- Max. repeatability	0,01 %	
- Linearity, terminal-based	0,01 %	
Span: 50 % of URL	See graph 2.2	
- Max. average errors	0,00 % and –0,05 %	
- Max. hysteresis	0,01 %	
- Max. repeatability	0,01 %	
- Linearity, terminal-based	0,01 %	
Span: 10 % of URL	See graph 2.3	
- Max. average errors	+0,00 % and –0,10 %	
- Max. hysteresis	0,02 %	
- Max. repeatability	0,01 %	
- Linearity, terminal-based	0,02 %	

Test number and subject for transmitter STD924	Measured and observed		Manufacturer's specifications	
Manual output				
Output range: 4...20 mA	See graph 2.4			
- Max. average errors	+0,03 % and –0,01 %			
- Max. hysteresis	0,01 %			
- Max. repeatability	<0,01 %			
General				
- Minimum current output	3,80 mA (–1,25 %)			
- Maximum current output	20,78 mA (104,8 %)			
- Output update rate	0,12 s			
02 Dead band				
Span: 100 % of URL	0,01 %			
Span: 50 % of URL	0,01 %			
Span: 10 % of URL	0,01 %			
09 Ambient temperature				
2 cycles between +85 °C and –40 °C				
Current output				
Reference: +20 °C	Zero shift	Span shift	Zero	Total
- Shift at +40 °C, cycle 1	–0,06 %	≤0,03 %	0,14 %	0,21 %
- Shift at +60 °C, cycle 1	–0,13 %	≤0,03 %	0,29 %	0,41 %
- Shift at +85 °C, cycle 1	–0,10 %	+0,22 %	0,46 %	0,67 %
- Shift at +20 °C, cycle 1	–0,09 %	≤0,03 %	---	---
- Shift at 0 °C, cycle 1	–0,11 %	≤0,03 %	0,14 %	0,21 %
- Shift at –20 °C, cycle 1	–0,09 %	≤0,03 %	0,29 %	0,41 %
- Shift at –40 °C, cycle 1	–0,04 %	+0,32 %	0,43 %	0,62 %
- Shift at +20 °C, cycle 2	–0,13 %	≤0,03 %	---	---
- Shift at +40 °C, cycle 2	–0,16 %	≤0,03 %	0,14 %	0,21 %
- Shift at +60 °C, cycle 2	–0,17 %	≤0,03 %	0,29 %	0,41 %
- Shift at +85 °C, cycle 2	–0,09 %	+0,22 %	0,46 %	0,67 %
- Shift at +20 °C, cycle 2	–0,12 %	≤0,03 %	---	---
- Shift at 0 °C, cycle 2	–0,12 %	≤0,03 %	0,14 %	0,21 %
- Shift at –20 °C, cycle 2	–0,10 %	≤0,03 %	0,29 %	0,41 %
- Shift at –40 °C, cycle 2	–0,05 %	+0,32 %	0,43 %	0,62 %
- Shift after the test	–0,14 %	≤0,03 %	---	---
	Graph 2.5 shows Zero shift. Graph 2.7 shows Shift at 100 %. Graph 2.9 shows Span shift.			
Temperature effect on linearity, measured at 50 % input				
- For all temperatures	No discernible effect			

Test number and subject for transmitter STD924	**Measured and observed**		**Manufacturer's specifications**	
Hysteresis at 50 % input				
- For all temperatures	≤0,03 %			
Digital output				
Reference: +20 °C	Zero shift	Span shift	Zero	Total
- Shift at +40 °C, cycle 1	–0,07 %	≤0,03 %	0,13 %	0,19 %
- Shift at +60 °C, cycle 1	–0,15 %	≤0,03 %	0,27 %	0,38 %
- Shift at +85 °C, cycle 1	–0,11 %	+0,19 %	0,44 %	0,61 %
- Shift at +20 °C, cycle 1	–0,09 %	≤0,03 %	---	---
- Shift at 0 °C, cycle 1	–0,10 %	≤0,03 %	0,13 %	0,19 %
- Shift at –20 °C, cycle 1	–0,09 %	≤0,03 %	0,27 %	0,38 %
- Shift at –40 °C, cycle 1	–0,03 %	+0,27 %	0,40 %	0,56 %
- Shift at +20 °C, cycle 2	–0,13 %	≤0,03 %	---	---
- Shift at +40 °C, cycle 2	–0,16 %	≤0,03 %	0,13 %	0,19 %
- Shift at +60 °C, cycle 2	–0,16 %	–0,06 %	0,27 %	0,38 %
- Shift at +85 °C, cycle 2	–0,11 %	+0,20 %	0,44 %	0,61 %
- Shift at +20 °C, cycle 2	–0,12 %	≤0,03 %	---	---
- Shift at 0 °C, cycle 2	–0,12 %	≤0,03 %	0,13 %	0,19 %
- Shift at –20 °C, cycle 2	–0,10 %	≤0,03 %	0,27 %	0,38 %
- Shift at –40 °C, cycle 2	–0,05 %	+0,27 %	0,40 %	0,56 %
- Shift after the test	–0,14 %	≤0,03 %	---	---
	Graph 2.6 shows Zero shift. Graph 2.8 shows Shift at 100 %. Graph 2.10 shows Span shift.			
Temperature effect on linearity, measured at 50 % input				
- For all temperatures	No discernible effect			
Hysteresis at 50 % input				
- For all temperatures	≤0,03 %			
Manual output				
Reference: +20 °C	Zero shift	Span shift		
- Shift at all temperatures	≤0,02 %	≤0,03 %		
Except for: Shift at –20 °C, cycle 1	≤0,02 %	+0,05 %		
Shift at –40 °C, cycle 1	≤0,02 %	+0,04 %		
Shift at –20 °C, cycle 2	≤0,02 %	+0,05 %		
Shift at –40 °C, cycle 2	≤0,02 %	+0,04 %		
- Shift after the test	≤0,02 %	≤0,03 %		
Sensor temperature Indication				
- Maximum error	At –40…+20 °C: 18 K At +20…+85 °C: 4 K See graph 5.1		5 K	

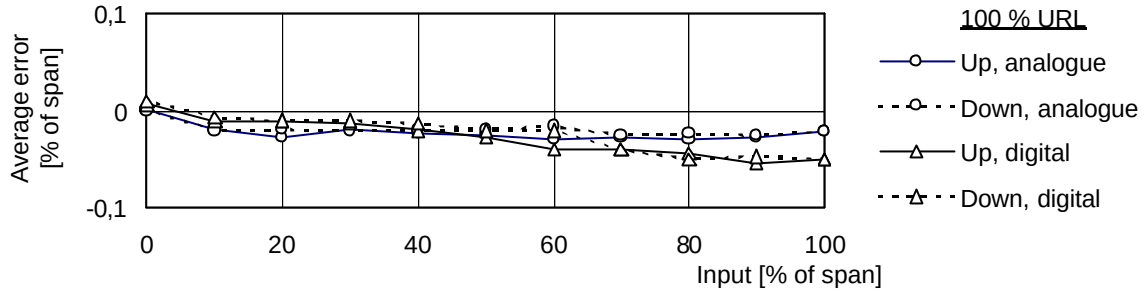
Test number and subject for transmitter STD924	Measured and observed	Manufacturer's specifications
Final six-point upscale calibration Max. average errors - Current output - Digital output	 –0,13 % and –0,25 % –0,13 % and –0,28 % See graph 2.11	
11 One sided heat radiation 1000 W/m², radiation on: H-chamber - Max. shift during radiation - Final shift during radiation - Final shift after stop radiation L-chamber - Max. shift during radiation - Final shift during radiation - Final shift after stop radiation	 Shift at 0 % input / Shift at 100 % input –0,04 % / +0,07 % –0,04 % / +0,07 % ≤0,03 % / ≤0,03 % –0,08 % / –0,05 % –0,08 % / ≤0,03 % ≤0,03 % / ≤0,03 %	
15 Static pressure test Span: 200 mbar (20 % of URL) - Shift at 50 bar - Shift at 100 bar - Shift at 150 bar - Shift at 200 bar - Shift at 0 bar, after the test	 Zero shift / Span shift ≤0,02 % / –0,15 % ≤0,02 % / –0,24 % +0,03 % / –0,16 % +0,06 % / –0,23 % ≤0,02 % / ≤0,03 % Graph 2.12 shows Zero shift. Graph 2.13 shows Shift at 100 %. Graph 2.14 shows Span shift.	Zero / Total 0,12 % / 0,21 % 0,23 % / 0,43 % 0,35 % / 0,64 % 0,46 % / 0,86 % --- / ---
18 Start-up drift - Shift between 5 min and 1 hour after start-up	 0 % input / 100 % input +0,04 % / +0,08 %	
19 Long term drift / Accelerated life test 4 tests of 10 days each: • Drift test, steady input: 100 % • Accelerated life test, 1 Hz • Drift test, steady input: 100 % • Accelerated life test, 1 Hz		0,3 % per year

Test number and subject for transmitter STD924	Measured and observed	Manufacturer's specifications
Shift: - after 10 days - after 20 days - after 30 days - after 40 days Drift of the output at 100 % input	Zero shift / Span shift ≤0,02 % / ≤0,03 % ≤0,02 % / ≤0,03 % ≤0,02 % / ≤0,03 % ≤0,02 % / ≤0,03 % Between: –0,01 % and +0,02 %	
29 Final accuracy *Current output* Shift of the final output span with respect to the initial output span Span: 100 % of URL, span shift Span: 50 % of URL, span shift Span: 10 % of URL, span shift *Increase of hysteresis* All spans Increase of repeatability All spans *Manual output* Shift of the manual output Zero shift Span shift	 ≤0,03 % ≤0,03 % –0,04 % ≤0,01 % ≤0,01 % ≤0,02 % ≤0,03 %	

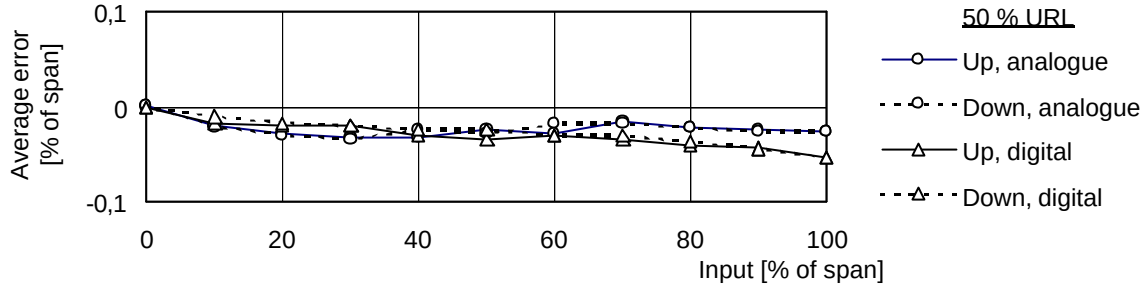
3.2.2 Aggravated tests

Test number and subject for transmitter STD924	Measured and observed	Manufacturer's specifications
31 Differential temperatures Electronics at 20 °C - Shift, when sensor at 80 °C - Shift, when sensor at 110 °C - Shift after the test	 Zero shift / Span shift +0,29 % / –0,49 % +0,65 % / –0,49 % +0,07 % / ≤0,03 %	
32 Static pressure cycling Static pressure variations: 56…84 bar, 100.000 cycles - Zero shift after 25.000 cycles - Zero shift after 50.000 cycles - Zero shift after 75.000 cycles - Zero shift after 100.000 cycles - Span shift after 100.000 cycles	 –0,04 % +0,02 % +0,06 % +0,09 % +0,07 %	

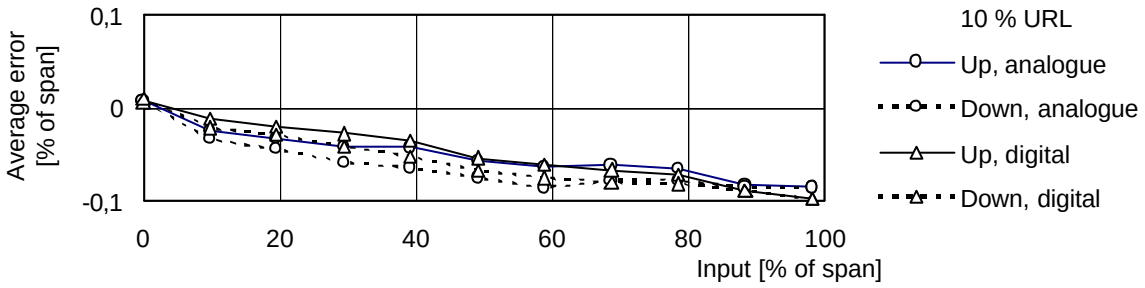
3.2.3 Graphs for STD924



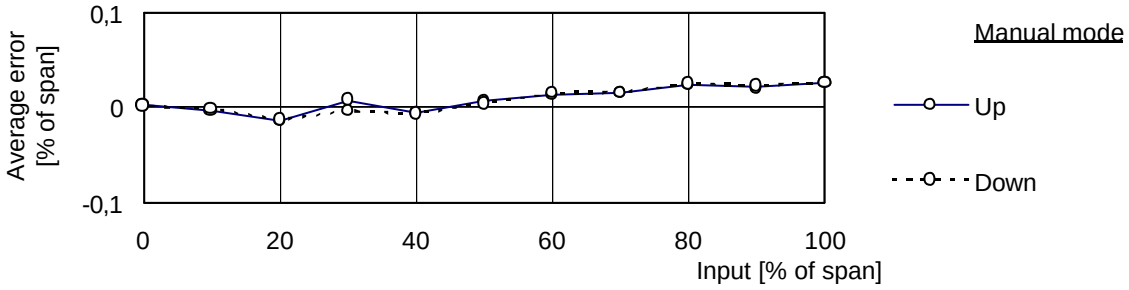
Graph 2.1 Accuracy STD924, span: 100 % URL



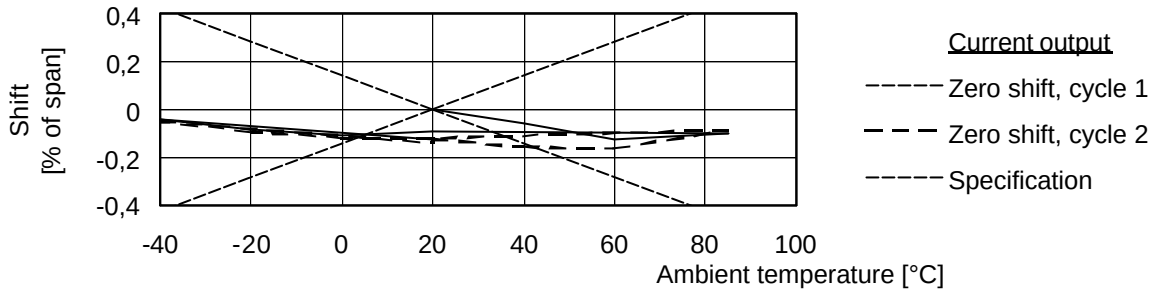
Graph 2.2 Accuracy STD924, span: 50 % URL



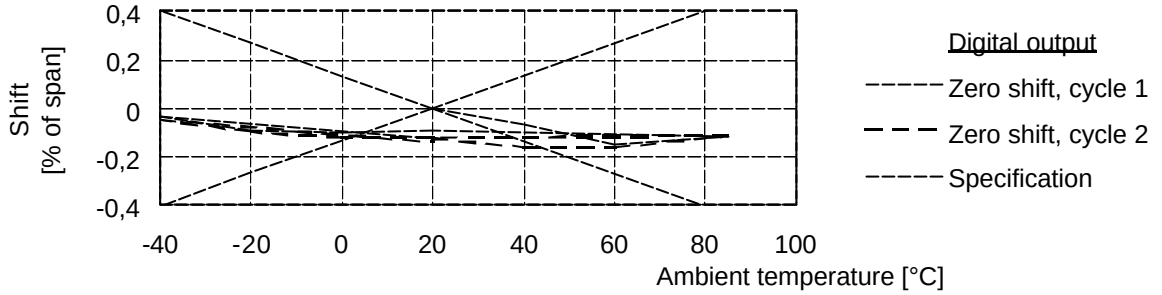
Graph 2.3 Accuracy STD924, span: 10 % URL



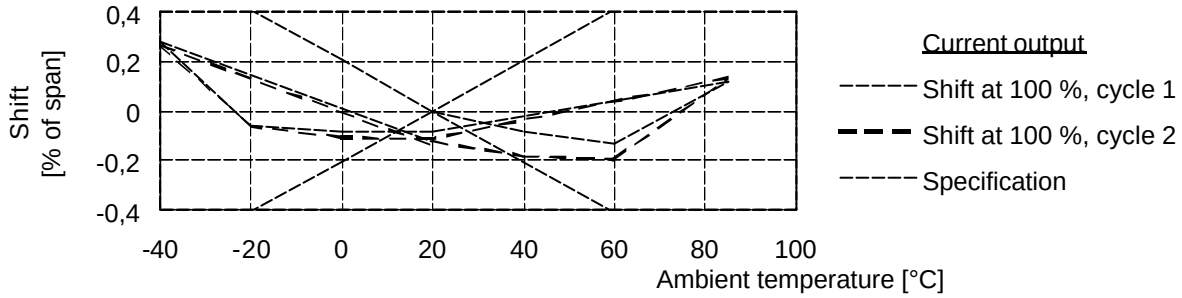
Graph 2.4 Accuracy STD924, manual mode



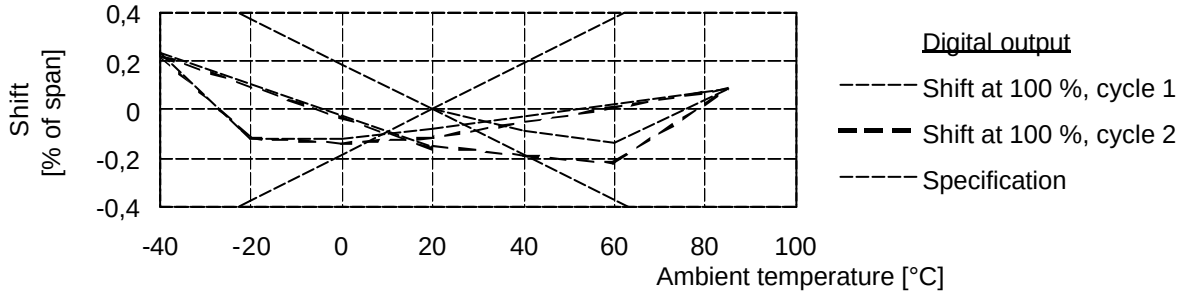
Graph 2.5 Temperature effect STD924: Zero shift of current output



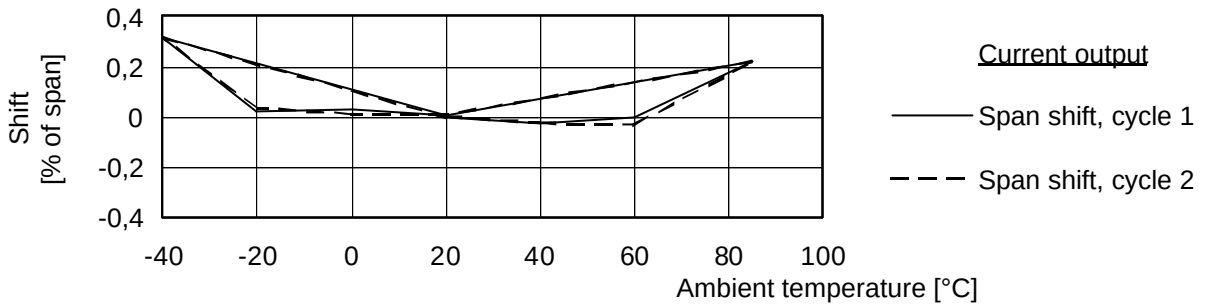
Graph 2.6 Temperature effect STD924: Zero shift of digital output



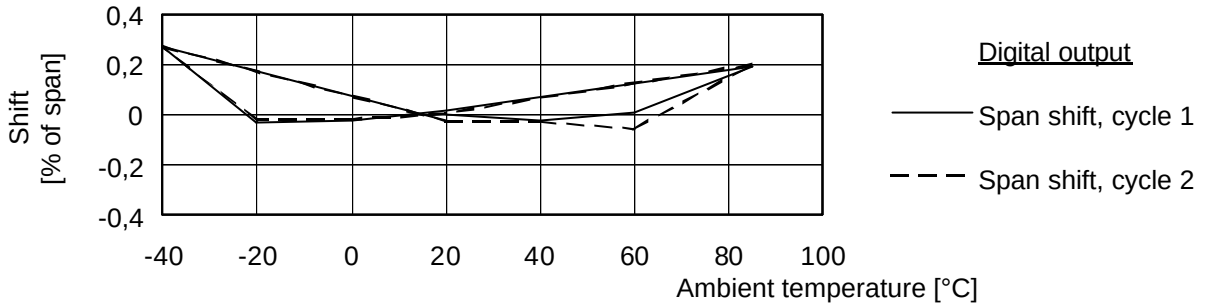
Graph 2.7 Temperature effect STD924: Shift of current output at 100 % input



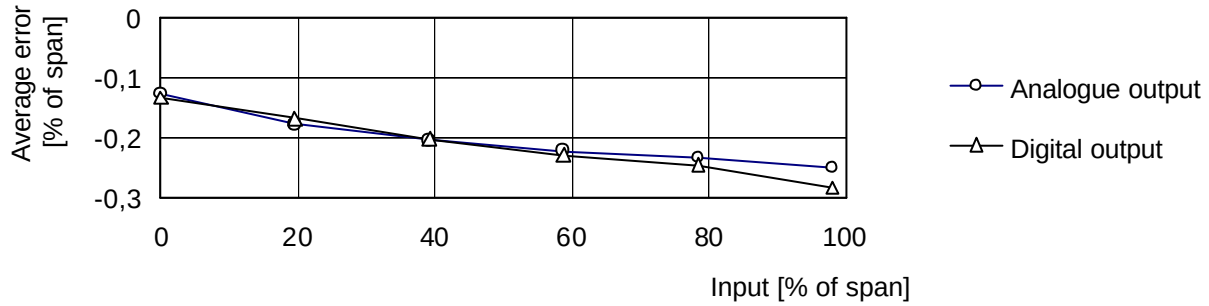
Graph 2.8 Temperature effect STD924: Shift of digital output at 100 % input



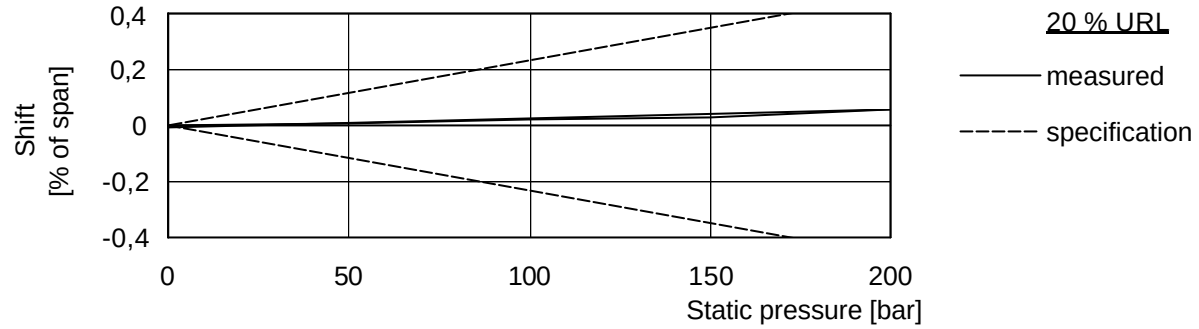
Graph 2.9 Temperature effect STD924: Span shift of current output



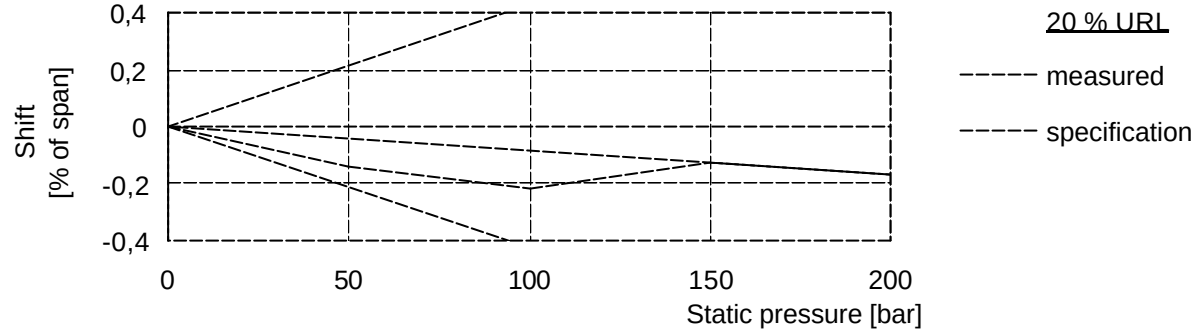
Graph 2.10 Temperature effect STD924: Span shift of digital output



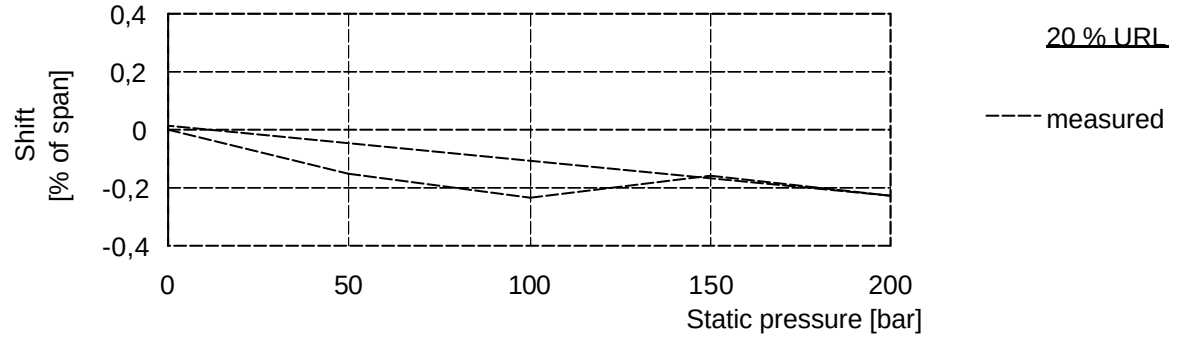
Graph 2.11 Accuracy STD924 after the temperature test



Graph 2.12 Static pressure effect STD924: Zero shift



Graph 2.13 Static pressure effect STD924: Shift at 100 % input



Graph 2.14 Static pressure effect STD924: Span shift

3.3 Results' summary of the GP transmitter STG14L

3.3.1 Standard WIB tests

Test number and subject for transmitter STG14L	Measured and observed	Manufacturer's specifications
01 Accuracy test		
Current output		
Span: 100 % of URL	See graph 3.1	Accuracy,
- Max. average errors	0,00 % and –0,03 %	Terminal based:
- Max. hysteresis	0,01 %	0,075 %
- Max. repeatability	0,01 %	
- Linearity, terminal-based	0,01 %	
Span: 50 % of URL	See graph 3.2	
- Max. average errors	0,00 % and –0,02 %	
- Max. hysteresis	0,02 %	
- Max. repeatability	0,01 %	
- Linearity, terminal-based	0,02 %	
Span: 10 % of URL	See graph 3.3	
- Max. average errors	+0,02 % and –0,02 %	
- Max. hysteresis	<0,01 %	
- Max. repeatability	<0,01 %	
- Linearity, terminal-based	0,01 %	
Digital output		
Span: 100 % of URL	See graph 3.1	Accuracy,
- Max. average errors	0,00 % and –0,04 %	Terminal based:
- Max. hysteresis	0,01 %	0,0625 %
- Max. repeatability	0,01 %	
- Linearity, terminal-based	0,01 %	
Span: 50 % of URL	See graph 3.2	
- Max. average errors	+0,01 % and –0,03 %	
- Max. hysteresis	<0,01 %	
- Max. repeatability	0,01 %	
- Linearity, terminal-based	0,01 %	
Span: 10 % of URL	See graph 3.3	
- Max. average errors	+0,01 % and –0,01 %	
- Max. hysteresis	0,01 %	
- Max. repeatability	0,01 %	
- Linearity, terminal-based	0,01 %	

Test number and subject for transmitter STG14L	Measured and observed		Manufacturer's specifications	
Manual output				
Output range: 4...20 mA	See graph 3.4			
- Max. average errors	+0,01 % and –0,02 %			
- Max. hysteresis	<0,01 %			
- Max. repeatability	<0,01 %			
General				
- Minimum current output	3,80 mA (-1,3 %)			
- Maximum current output	20,8 mA (105 %)			
- Output update rate	0,12 s			
02 Dead band				
Span: 100 % of URL	0,01 %			
Span: 50 % of URL	0,01 %			
Span: 10 % of URL	0,01 %			
09 Ambient temperature				
2 cycles between +85 °C and –40 °C				
Current output				
Reference: +20 °C	Zero shift	Span shift	Zero	Total
- Shift at +40 °C	≤0,02 %	≤0,03 %	0,04 %	0,07 %
- Shift at +60 °C	≤0,02 %	≤0,03 %	0,09 %	0,14 %
- Shift at +85 °C	–0,06 %	–0,08 %	0,15 %	0,23 %
- Shift at +20 °C	–0,06 %	≤0,03 %	---	---
- Shift at 0 °C	–0,06 %	+0,04 %	0,04 %	0,07 %
- Shift at –20 °C	–0,06 %	+0,04 %	0,09 %	0,14 %
- Shift at –40 °C	–0,04 %	+0,07 %	0,13 %	0,21 %
- Shift at +20 °C	≤0,02 %	≤0,03 %	---	---
- Shift at +40 °C	≤0,02 %	≤0,03 %	0,04 %	0,07 %
- Shift at +60 °C	≤0,02 %	≤0,03 %	0,09 %	0,14 %
- Shift at +85 °C	–0,05 %	–0,08 %	0,15 %	0,23 %
- Shift at +20 °C	–0,06 %	≤0,03 %	---	---
- Shift at 0 °C	–0,05 %	≤0,03 %	0,04 %	0,07 %
- Shift at –20 °C	–0,06 %	+0,04 %	0,09 %	0,14 %
- Shift at –40 °C	–0,04 %	+0,07 %	0,13 %	0,21 %
- Shift after the test	–0,03 %	≤0,03 %	---	---
	Graph 3.5 shows Zero shift. Graph 3.7 shows Shift at 100 %. Graph 3.9 shows Span shift.			
Temperature effect on linearity, measured at 50 % input				
- For all temperatures	No discernible effect			

Test number and subject for transmitter STG14L	**Measured and observed**		**Manufacturer's specifications**	
Hysteresis at 50 % input				
- For all temperatures	≤0,02 %			
Digital output				
Reference: +20 °C	Zero shift	Span shift	Zero	Total
- Shift at +40 °C	≤0,02 %	≤0,03 %	0,04 %	0,05 %
- Shift at +60 °C	≤0,02 %	–0,04 %	0,07 %	0,11 %
- Shift at +85 °C	–0,06 %	–0,07 %	0,12 %	0,17 %
- Shift at +20 °C	–0,05 %	≤0,03 %	---	---
- Shift at 0 °C	–0,05 %	≤0,03 %	0,04 %	0,05 %
- Shift at –20 °C	–0,04 %	≤0,03 %	0,07 %	0,11 %
- Shift at –40 °C	≤0,02 %	+0,06 %	0,11 %	0,16 %
- Shift at +20 °C	≤0,02 %	≤0,03 %	---	---
- Shift at +40 °C	≤0,02 %	≤0,03 %	0,04 %	0,05 %
- Shift at +60 °C	–0,03 %	≤0,03 %	0,07 %	0,11 %
- Shift at +85 °C	–0,05 %	–0,08 %	0,12 %	0,17 %
- Shift at +20 °C	–0,06 %	≤0,03 %	---	---
- Shift at 0 °C	–0,05 %	≤0,03 %	0,04 %	0,05 %
- Shift at –20 °C	–0,05 %	≤0,03 %	0,07 %	0,11 %
- Shift at –40 °C	–0,03 %	+0,08 %	0,11 %	0,16 %
- Shift after the test	≤0,02 %	≤0,03 %	---	---
	Graph 3.6 shows Zero shift. Graph 3.8 shows Shift at 100 %. Graph 3.10 shows Span shift.			
Temperature effect on linearity, measured at 50 % input				
- For all temperatures	No discernible effect			
Hysteresis at 50 % input				
- For all temperatures	≤0,01 %			
Manual output				
Reference: +20 °C	Zero shift	Span shift		
- Shift at all temperatures	≤0,02 %	≤0,03 %		
Sensor temperature Indication				
- Maximum error	At –40…+85 °C: 4 K See graph 5.1		5 K	
Final six-point upscale calibration				
Max. average errors				
- Current output	0,00 % and –0,04 %			
- Digital output	–0,01 % and –0,02 %			
	See graph 3.11			

Test number and subject for transmitter STG14L	Measured and observed	Manufacturer's specifications
12 Mounting position		
Tilting in any direction	Zero shift / Span shift	
- Maximum shift at ±10°	≤0,02 % / ≤0,03 %	
- Maximum shift at ±90°	±0,07 % / ≤0,03 %	
13 Vibration		
Max. amplitude: 0,07 mm		
Max. acceleration: 1 g		
Frequency range: 10...500 Hz		
Vertical		
- Resonance of electronics housing	No resonance	
- Maximum shift	≤0,2 %	
Horizontal-Transversal		
- Resonance of electronics housing	90 Hz, Q = 24	
- Maximum shift	≤0,2 %	
Horizontal-Longitudinal		
- Resonance of electronics housing	83 Hz, Q = 20	
- Maximum shift	≤0,2 %	
Behaviour during all tests	Correct operation	
Span shift after the test	≤0,03 %	
14 Overranging		
Pressure: 50 bar		
Output during overrange	105 % (20,8 mA)	
Display during overrange	Alternating: 200,00 % and O–L.	
Output on HHC	200,00 %	
Shift after 5 min. recovery	Zero: ≤0,02 %; Span: ≤0,03 %	
19 Long term drift		
Drift of the output at 90 % input	Between: –0,02 % and +0,01 %	0,3 % per year
23 Step response time	Settling time for 1 % tolerance:	
Damping: zero	Up / Down	
- Input: 45 % ↔ 55 %	0,54 s / 0,50 s	
- Input: 10 % ↔ 90 %	0,80 s / 0,74 s	
24 Frequency response		
Span: 10 % of URL		
Damping: zero		
Amplitude: 10 % peak-to-peak		
- Relative gain	Bode diagram: Graph 3.12	
- The gain reduced to 0,7 at	1,2 Hz	
- The phase lag was 45° at	0,40 Hz	

Test number and subject for transmitter STG14L	Measured and observed	Manufacturer's specifications
26 Effect of long wires 1000 m of multi-wire cable, DRACODA 9100, between instrument and HHC - Effect on communication via HHC	 No effect	
29 Final accuracy *Current output* *Manual output*	 Not tested, instrument defect Not tested, instrument defect	

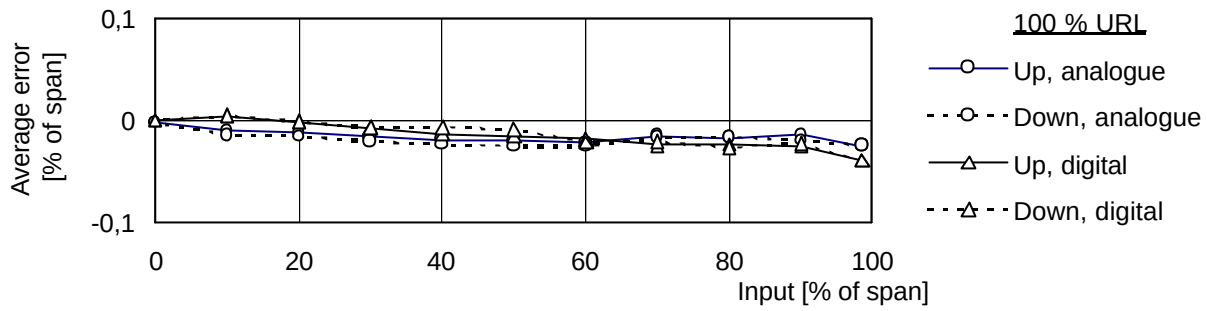
3.3.2 Aggravated tests

Test number and subject for transmitter STG14L	Measured and observed	Manufacturer's specifications
31 Differential temperatures Electronics at 20 °C - Shift, when sensor at 80 °C - Shift, when sensor at 110 °C - Shift after the test	 <u>Zero shift</u> <u>Span shift</u> +0,07 % –0,43 % +0,10 % –0,56 % –0,03 % ≤0,03 %	
33 Vibration / Endurance test Maximum amplitude: 3,17 mm Maximum acceleration: 3 g Frequency range: 5…500 Hz For each of the 3 main directions: - Resonance search - Shift during resonance search - Endurance test: 30 min at the lowest main resonance frequency *Vertical* - Resonance of electronics housing - Maximum shift - Endurance test at 23 Hz, effects *Horizontal – Transversal* - Resonance of electronics housing - Maximum shift - Endurance test at 82 Hz, effects	 No resonance ≤0,2% Correct output during the test 82 Hz, Q = 22 ≤0,2% After 22 minutes: - Frequent reset of electronics. After 28 minutes: - Instrument defect: Output: 21 mA Display: – – – and a '#' sign Status: Invalid database	

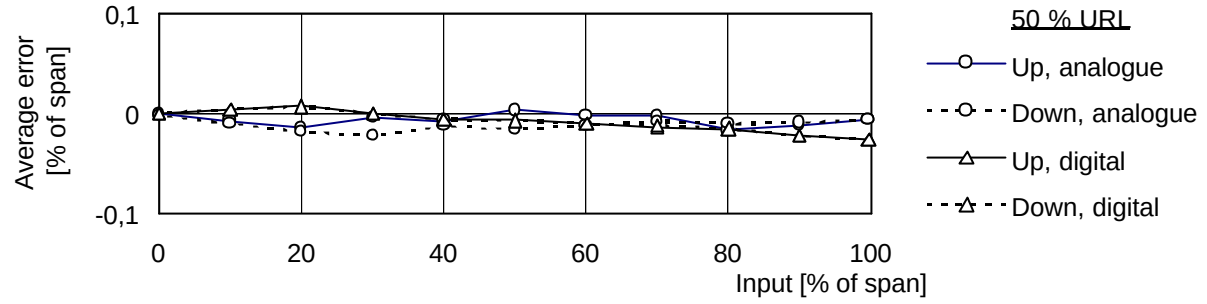
Test number and subject for transmitter STG14L	Measured and observed	Manufacturer's specifications
Horizontal – Longitudinal	Not tested; instrument defect	
Span shift after the test	Not applicable; instrument defect.	

3.3.3 Graphs for STG14L

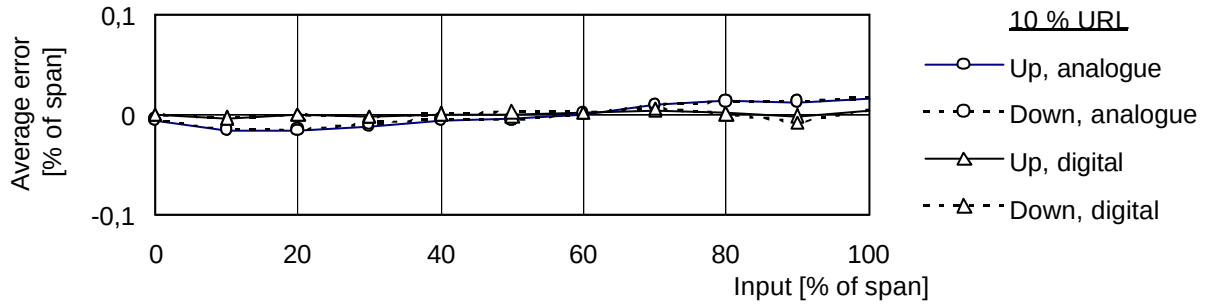
See the next pages.



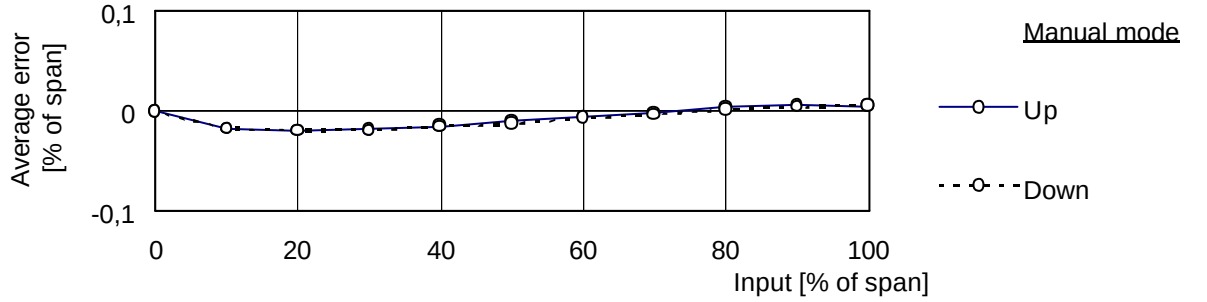
Graph 3.1 Accuracy STG14L, span: 100 % URL



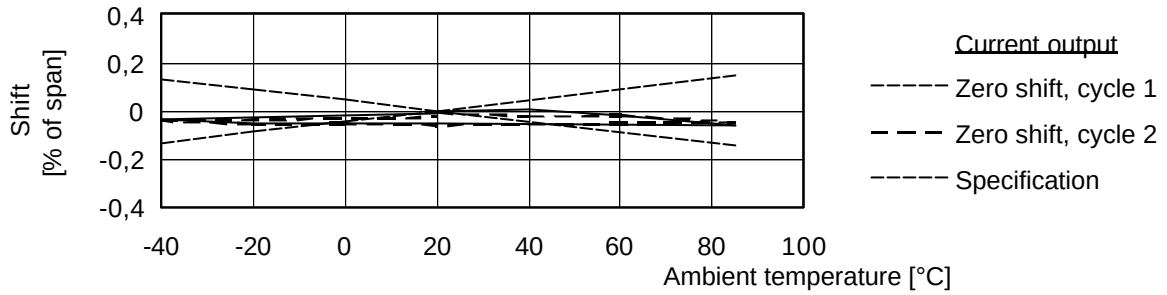
Graph 3.2 Accuracy STG14L, span: 50 % URL



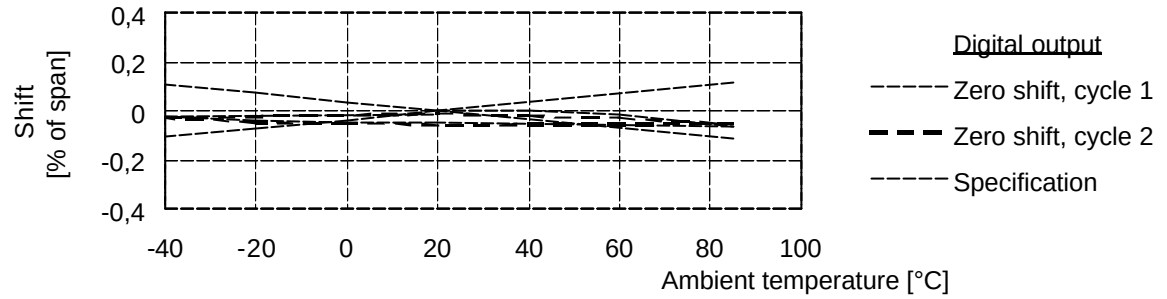
Graph 3.3 Accuracy STG14L, span: 10 % URL



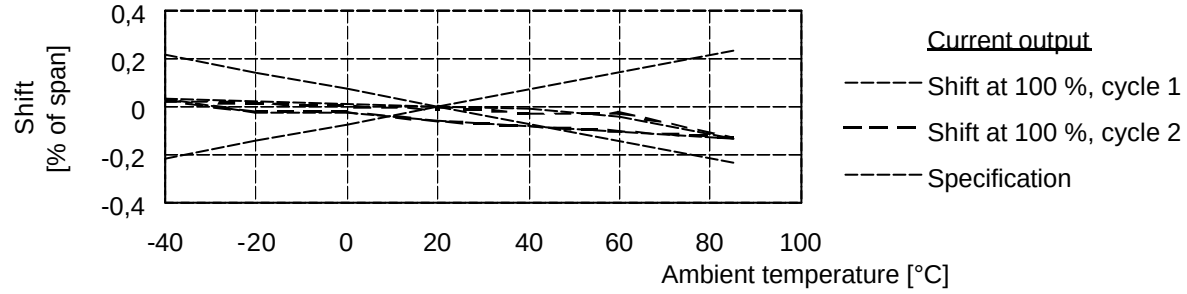
Graph 3.4 Accuracy STG14L, manual mode



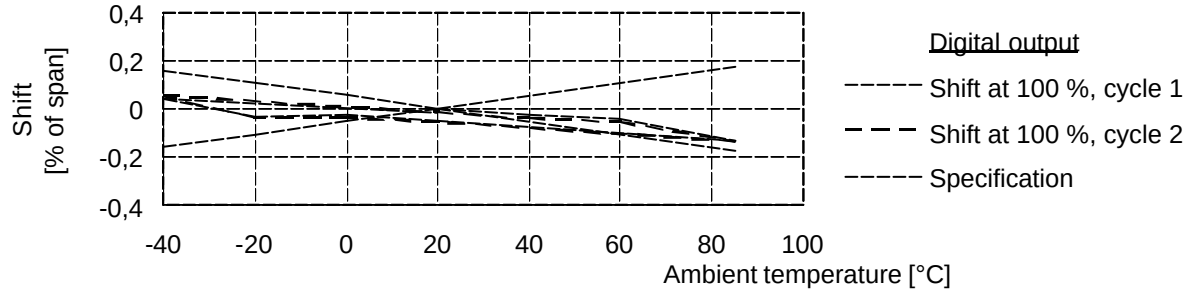
Graph 3.5 Temperature effect STG14L: Zero shift of current output



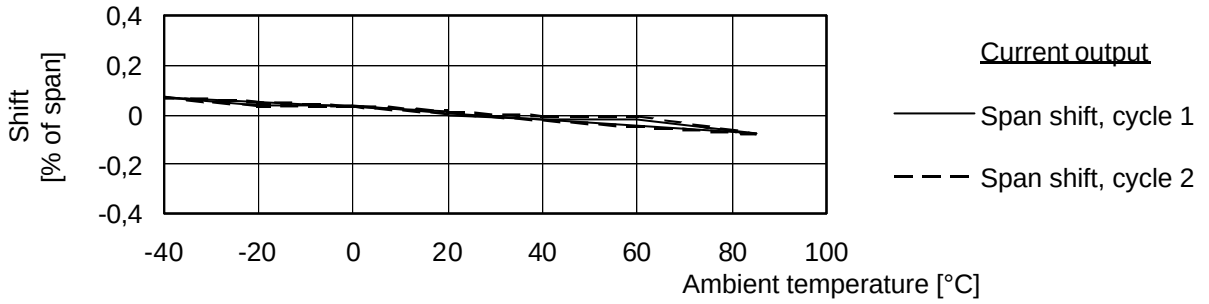
Graph 3.6 Temperature effect STG14L: Zero shift of digital output



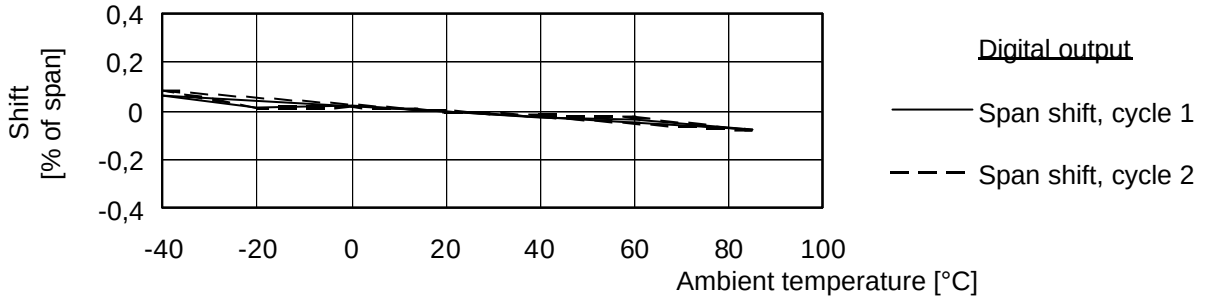
Graph 3.7 Temperature effect STG14L: Shift of current output at 100 % input



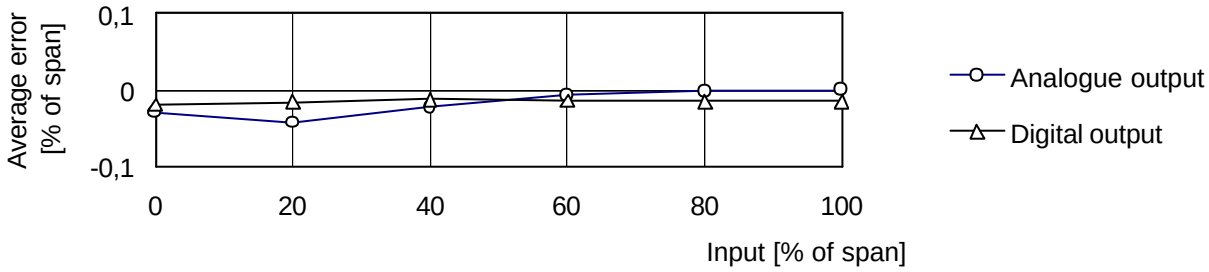
Graph 3.8 Temperature effect STG14L: Shift of digital output at 100 % input



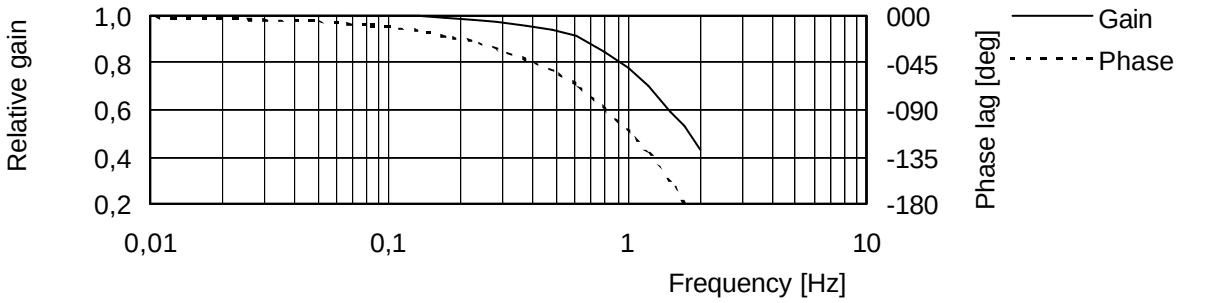
Graph 3.9 Temperature effect STG14L: Span shift of current output



Graph 3.10 Temperature effect STG14L: Span shift of digital output



Graph 3.11 Accuracy STG14L after the temperature test



Graph 3.12 Bode diagram STG14L

3.4 Results' summary of the GP transmitter STG94L

3.4.1 Standard WIB tests

Test number and subject for transmitter STG94L	Measured and observed	Manufacturer's specifications
01 Accuracy test		
Current output		
Span: 100 % of URL	See graph 4.1	Accuracy,
- Max. average errors	0,00 % and –0,03 %	Terminal based:
- Max. hysteresis	0,01 %	0,1 %
- Max. repeatability	0,01 %	
- Linearity, terminal-based	0,02 %	
Span: 50 % of URL	See graph 4.2	
- Max. average errors	0,00 % and –0,02 %	
- Max. hysteresis	0,01 %	
- Max. repeatability	0,01 %	
- Linearity, terminal-based	0,01 %	
Span: 10 % of URL	See graph 4.3	
- Max. average errors	+0,02 % and –0,02 %	
- Max. hysteresis	0,01 %	
- Max. repeatability	0,01 %	
- Linearity, terminal-based	0,02 %	
Digital output		
Span: 100 % of URL	See graph 4.1	Accuracy,
- Max. average errors	0,00 % and –0,04 %	Terminal based:
- Max. hysteresis	0,01 %	0,075 %
- Max. repeatability	0,01 %	
- Linearity, terminal-based	0,01 %	
Span: 50 % of URL	See graph 4.2	
- Max. average errors	0,00 % and –0,04 %	
- Max. hysteresis	0,01 %	
- Max. repeatability	0,01 %	
- Linearity, terminal-based	0,01 %	
Span: 10 % of URL	See graph 4.3	
- Max. average errors	+0,01 % and 0,00 %	
- Max. hysteresis	0,01 %	
- Max. repeatability	0,01 %	
- Linearity, terminal-based	0,01 %	

Test number and subject for transmitter STG94L	Measured and observed		Manufacturer's specifications	
Manual output				
Output range: 4...20 mA	See graph 4.4			
- Max. average errors	+0,01 % and –0,02 %			
- Max. hysteresis	<0,01 %			
- Max. repeatability	<0,01 %			
General				
- Minimum current output	3,80 mA (–1,25 %)			
- Maximum current output	20,8 mA (105 %)			
02 Dead band				
Span: 100 % of URL	0,01 %			
Span: 50 % of URL	0,01 %			
Span: 10 % of URL	0,01 %			
09 Ambient temperature				
2 cycles between +85 °C and –40 °C				
Current output				
Reference: +20 °C	Zero shift	Span shift	Zero	Total
- Shift at +40 °C, cycle 1	≤0,02 %	≤0,03 %	0,12 %	0,18 %
- Shift at +60 °C, cycle 1	≤0,02 %	–0,07 %	0,23 %	0,36 %
- Shift at +85 °C, cycle 1	+0,10 %	≤0,03 %	0,38 %	0,58 %
- Shift at +20 °C, cycle 1	≤0,02 %	≤0,03 %	---	---
- Shift at 0 °C, cycle 1	–0,03 %	+0,21 %	0,12 %	0,18 %
- Shift at –20 °C, cycle 1	≤0,02 %	+0,04 %	0,38 %	0,36 %
- Shift at –40 °C, cycle 1	≤0,02 %	+0,24 %	0,35 %	0,54 %
- Shift at +20 °C, cycle 2	≤0,02 %	≤0,03 %	---	---
- Shift at +40 °C, cycle 2	≤0,02 %	≤0,03 %	0,12 %	0,18 %
- Shift at +60 °C, cycle 2	≤0,02 %	–0,07 %	0,23 %	0,36 %
- Shift at +85 °C, cycle 2	+0,10 %	+0,04 %	0,38 %	0,58 %
- Shift at +20 °C, cycle 2	≤0,02 %	≤0,03 %	---	---
- Shift at 0 °C, cycle 2	–0,03 %	+0,20 %	0,12 %	0,18 %
- Shift at –20 °C, cycle 2	–0,03 %	+0,04 %	0,38 %	0,36 %
- Shift at –40 °C, cycle 2	≤0,02 %	+0,25 %	0,35 %	0,54 %
- Shift after the test	≤0,02 %	≤0,03 %	---	---
	Graph 4.5 shows Zero shift. Graph 4.7 shows Shift at 100 %. Graph 4.9 shows Span shift.			
Temperature effect on linearity, measured at 50 % input				
- For all temperatures	No discernible effect			

Test number and subject for transmitter STG94L	**Measured and observed**		**Manufacturer's specifications**	
Hysteresis at 50 % input				
- For all temperatures	≤0,02 %			
Digital output				
Reference: +20 °C	Zero shift	Span shift	Zero	Total
- Shift at +40 °C, cycle 1	≤0,02 %	≤0,03 %	0,11 %	0,16 %
- Shift at +60 °C, cycle 1	≤0,02 %	–0,06 %	0,21 %	0,32 %
- Shift at +85 °C, cycle 1	+0,08 %	≤0,03 %	0,35 %	0,52 %
- Shift at +20 °C, cycle 1	–0,03 %	≤0,03 %	---	---
- Shift at 0 °C, cycle 1	–0,04 %	+0,16 %	0,11 %	0,16 %
- Shift at –20 °C, cycle 1	–0,04 %	≤0,03 %	0,21 %	0,32 %
- Shift at –40 °C, cycle 1	≤0,02 %	+0,20 %	0,32 %	0,48 %
- Shift at +20 °C, cycle 2	≤0,02 %	≤0,03 %	---	---
- Shift at +40 °C, cycle 2	≤0,02 %	≤0,03 %	0,11 %	0,16 %
- Shift at +60 °C, cycle 2	≤0,02 %	–0,06 %	0,21 %	0,32 %
- Shift at +85 °C, cycle 2	+0,07 %	≤0,03 %	0,35 %	0,52 %
- Shift at +20 °C, cycle 2	–0,03 %	≤0,03 %	---	---
- Shift at 0 °C, cycle 2	–0,04 %	+0,15 %	0,11 %	0,16 %
- Shift at –20 °C, cycle 2	–0,04 %	≤0,03 %	0,21 %	0,32 %
- Shift at –40 °C, cycle 2	≤0,02 %	+0,22 %	0,32 %	0,48 %
- Shift after the test	≤0,02 %	≤0,03 %	---	---
	Graph 4.6 shows Zero shift. Graph 4.8 shows Shift at 100 %. Graph 4.10 shows Span shift.			
Temperature effect on linearity, measured at 50 % input				
- For all temperatures	No discernible effect			
Hysteresis at 50 % input				
- For all temperatures	≤0,02 %			
Manual output				
Reference: +20 °C	Zero shift	Span shift		
- Shift at all temperatures	≤0,02 %	≤0,03 %		
Except for: Shift at 0 °C, cycle 1	≤0,02 %	+0,04 %		
Shift at –20 °C, cycle 1	≤0,02 %	+0,06 %		
Shift at –40 °C, cycle 1	≤0,02 %	+0,04 %		
Shift at 0 °C, cycle 2	≤0,02 %	+0,04 %		
Shift at –40 °C, cycle 2	≤0,02 %	+0,06 %		
- Shift after the test	≤0,02 %	≤0,03 %		
Sensor temperature Indication				
- Maximum error	At –40…+85 °C: 4 K See graph 5.1		5 K	

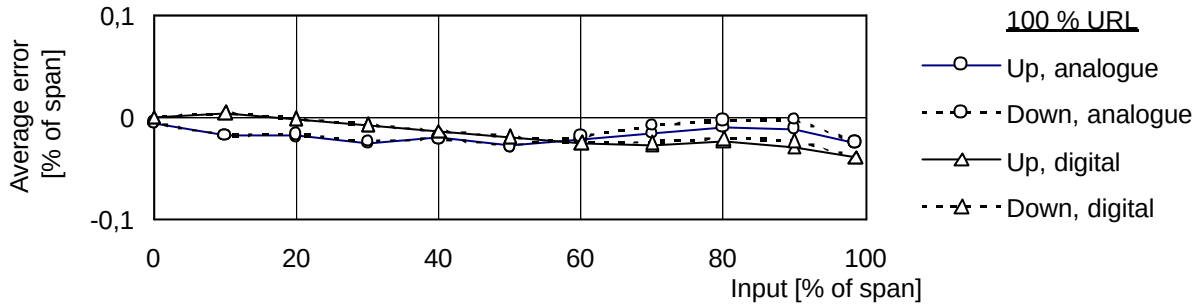
Test number and subject for transmitter STG94L	Measured and observed	Manufacturer's specifications
Final six-point upscale calibration Max. average errors - Current output - Digital output	 –0,01 % and –0,03 % +0,00 % and –0,01 % See graph 4.11	
19 Long term drift Drift of the output at 90 % input	 Between: 0,00 % and +0,02 %	 0,3 % per year
29 Final accuracy *Current output* Shift of the final output span with respect to the initial output span Span: 100 % of URL, span shift Span: 50 % of URL, span shift Span: 10 % of URL, span shift *Increase of hysteresis* All spans Increase of repeatability All spans *Manual output* Shift of the manual output Zero shift Span shift	 ≤0,03 % –0,04 % ≤0,03 % ≤0,01 % ≤0,01 % ≤0,02 % ≤0,03 %	

3.4.2 Aggravated tests

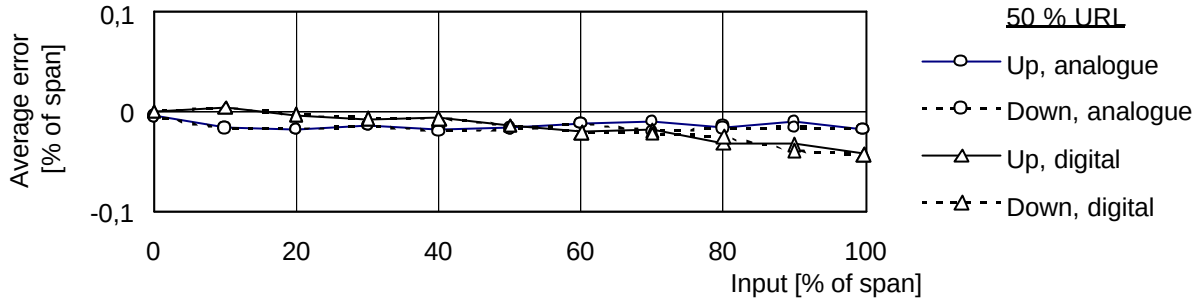
Test number and subject for transmitter STG94L	Measured and observed		Manufacturer's specifications
31 Differential temperatures			
Electronics at 20 °C	<u>Zero shift</u>	<u>Span shift</u>	
- Shift, when sensor at 80 °C	+0,14 %	–0,48 %	
- Shift, when sensor at 110 °C	+0,28 %	–0,70 %	
- Shift after the test	≤0,02 %	≤0,03 %	

3.4.3 Graphs for STG94L

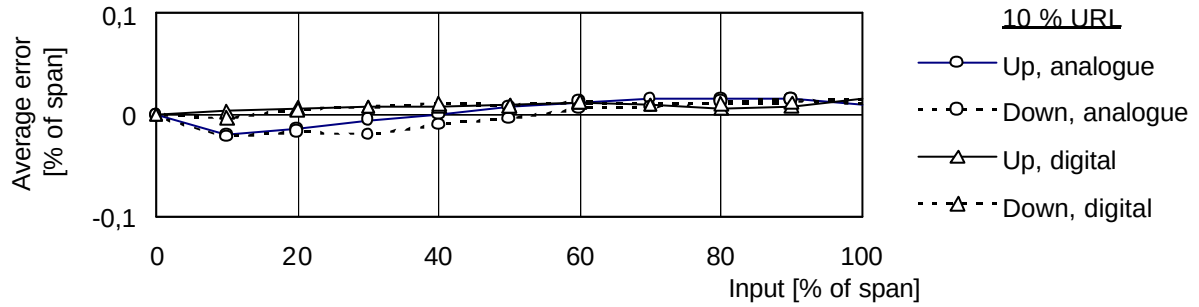
See the next pages.



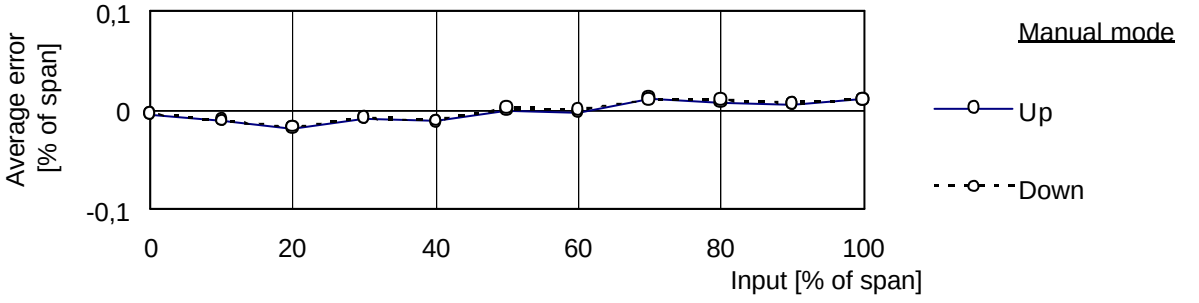
Graph 4.1 Accuracy STG94L, span: 100 % URL



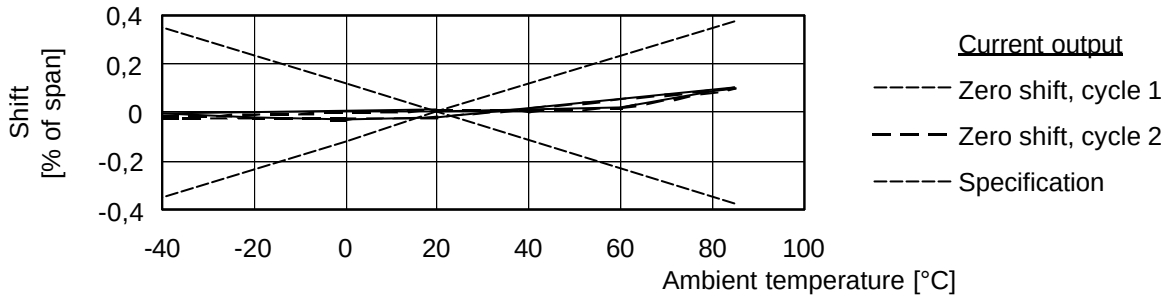
Graph 4.2 Accuracy STG94L, span: 50 % URL



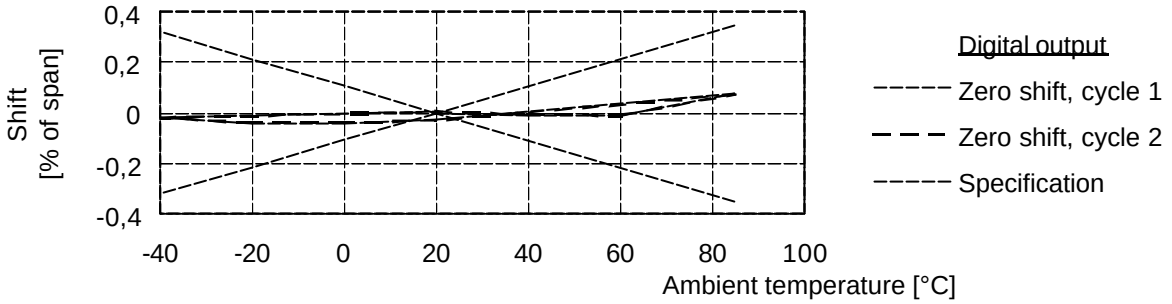
Graph 4.3 Accuracy STG94L, span: 10 % URL



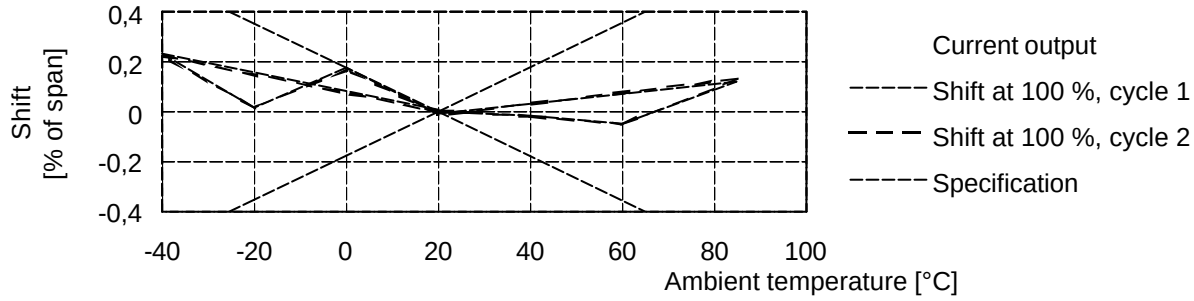
Graph 4.4 Accuracy STG94L, manual mode



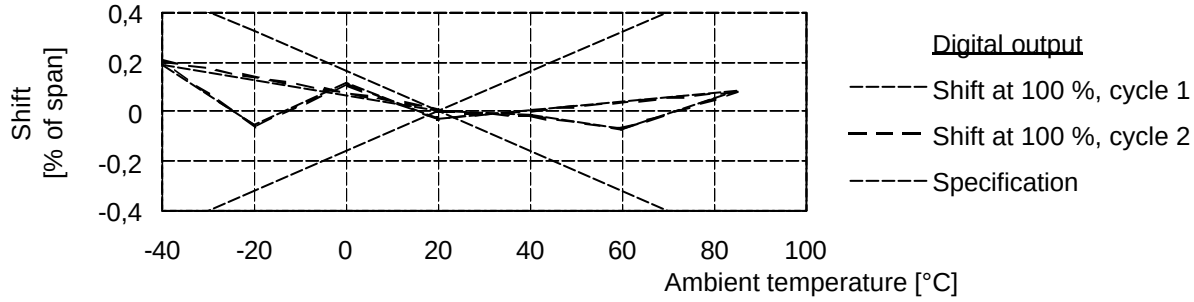
Graph 4.5 Temperature effect STG94L: Zero shift of current output



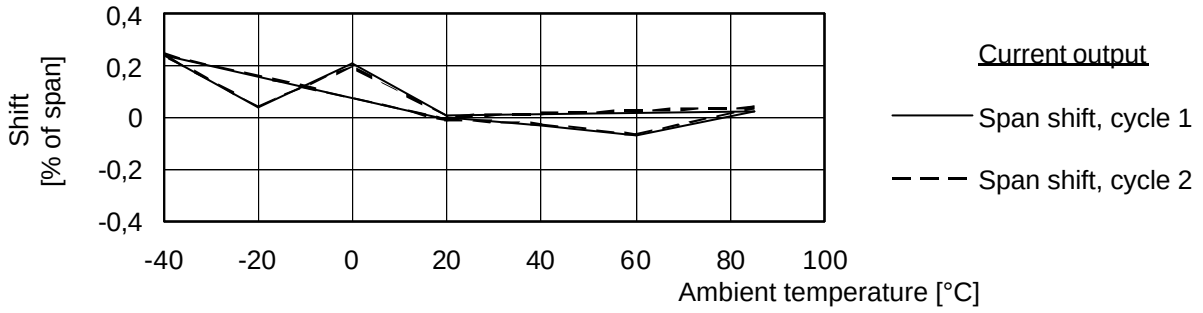
Graph 4.6 Temperature effect STG94L: Zero shift of digital output



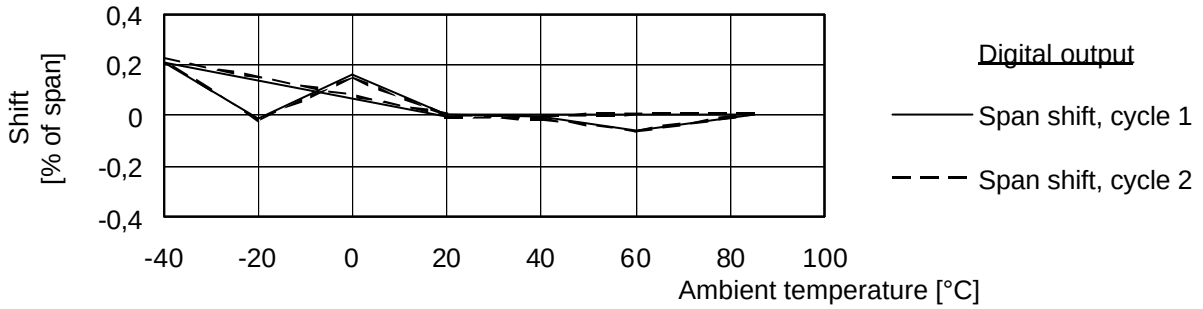
Graph 4.7 Temperature effect STG94L: Shift of current output at 100 % input



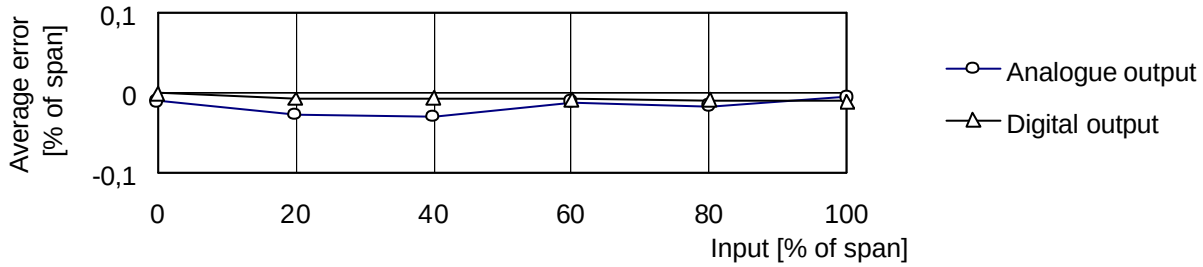
Graph 4.8 Temperature effect STG94L: Shift of digital output at 100 % input



Graph 4.9 Temperature effect STG94L: Span shift of current output

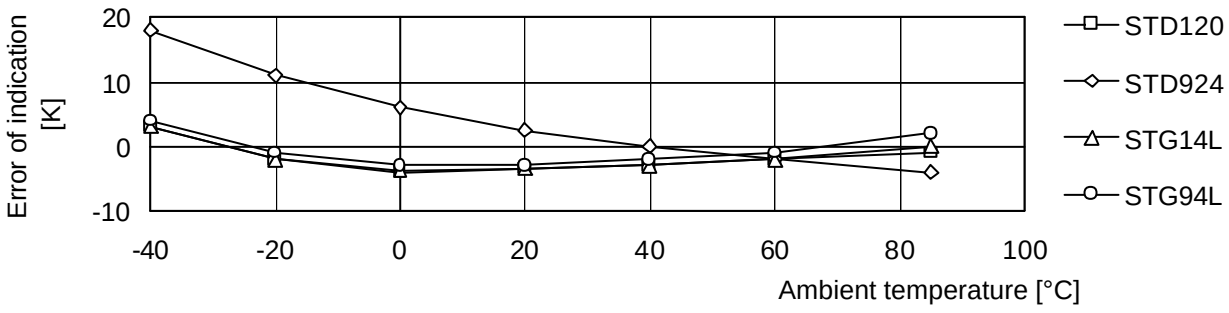


Graph 4.10 Temperature effect STG94L: Span shift of digital output



Graph 4.11 Accuracy STG94L after the temperature test

3.5 Graph for all instruments



Graph 5.1 Errors of the temperature sensors in the transmitters

4. MANUFACTURER'S DATA

Instrument specifications and other details provided by the manufacturer.

Manufacturer Honeywell, Industrial Automation & Control
16404 North Black Canyon Highway
Phoenix, Arizona 85023–3099, USA

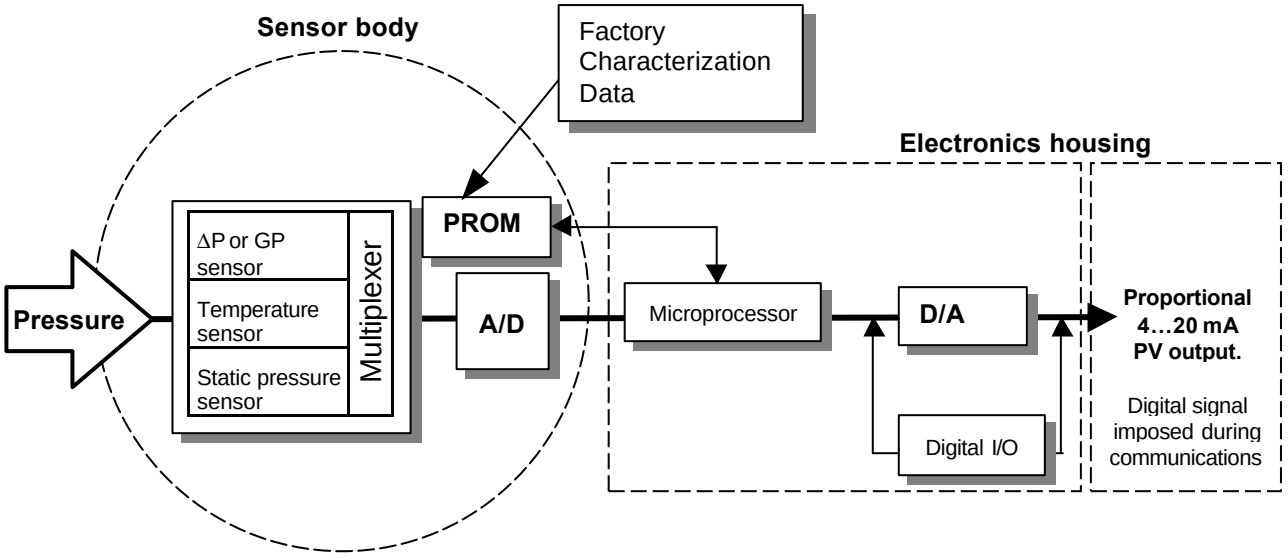
Supplier Honeywell B.V.
Laarderhoogtweg 18, 1101 EA Amsterdam Z.O., The Netherlands

Instrument Type	ΔP Series 100	ΔP Series 900	GP Series 100	GP Series 900
Model	STD120	STD924	STG14L	STG94L
Upper Range Limit (URL)	1000 mbar	1000 mbar	35 barg	35 barg
Meter body & options code	E1A-1C-SM-ZS	A1A-1C-SM-ZS	E1G-1C-SM-ZS	E1G-1C-SM-ZS
Software version	3.5	B.5	3.5	B.5
Turndown ratio	400 to 1	40 to 1	100 to 1	25 to 1
Maximum negative input	–50 mbar	–50 mbar	–1 bar	–1 bar
Accuracy *				
Accuracy* for span	≥62 mbar	≥62 mbar	≥1,4 bar	≥1,4 bar
Analogue output	0,075 %	0,10 %	0,075 %	0,10 %
Digital output	0,0625 %	0,075 %	0,0625 %	0,075 %
Temperature				
Effect per 28 K, for span	≥125 mbar	≥125 mbar	≥3,5 bar	≥3,5 bar
Zero shift, analogue	0,0625 %	0,1625 %	0,0625 %	0,1625 %
Zero shift, digital	0,05 %	0,15 %	0,05 %	0,15 %
Zero + span shift, analogue	0,10 %	0,25 %	0,10 %	0,25 %
Zero + span shift, digital	0,075 %	0,225 %	0,075 %	0,225 %
Temperature limits for electronics	–40…+93 °C	–40… +85 °C	–40…+93 °C	–40… +85 °C
Temperature limits for sensor	–40…+125 °C	–40…+125 °C	–40…+125 °C	–40…+110 °C
Relative humidity, limits	0…100 %	0…100 %	0…100 %	0…100 %
Static pressure				
Effect per 70 bar, for span	≥125 mbar	≥125 mbar		
Zero shift	0,075 %	0,1625 %		
Zero + span shift	0,15 %	0,30 %		
Maximum static pressure	210 bar	210 bar		
Maximum overrange pressure	210 bar	210 bar	50 bar	50 bar
Supply voltage, limits & effects	10,8 V and 42,4 V, Supply voltage effect: 0,005 % per Volt			
Output load	0 Ω and 1440 Ω; min. 250 Ω for use with the Handheld Communicator			
CE Conformity	89/336/EEC, industrial environment; effects are not specified			
Electronic housing	Meets NEMA 4x (watertight) and NEMA 7 (explosion proof)			
Approval bodies	Approved as explosion proof and intrinsically safe for use in Class I, Division 1, Groups A, B, C, D locations, nonincendive for Class I, Division 2, Groups A, B, C, D locations. Approved EEx ia IIC T5 and EEX d IIC T6 per CENELEC standards; and Ex N II T5 per BS 6941.			

*Accuracy: The specification includes terminal based accuracy, linearity, hysteresis and repeatability.

5. OPERATING PRINCIPLE AND CONSTRUCTION

5.1 Operating principle



The transmitter measures the process pressure and transmits an output signal, proportional to the measured variable, over a 4 to 20 m A, two-wire loop. Its major components are an electronics housing and a sensor body as shown in the figure.
The ST3000 transmits its output in

- either an analogue 4 to 20 mA format with digital transmission to the HHC,
- or a digital DE protocol format for direct digital communications with TPS system, Allen-Bradley PLC and other control systems.

The transmitter provides the sensor body temperature as read-only variable.

The smart function includes facilities at the HHC for setting of range, calibration of zero and span, fine adjustment of the output current, adjustment of damping, generation of an output current in the manual mode, status information, reset of the calibration data of the transmitter and trouble shooting. The functions can be entered via a menu structure at the HHC.

5.2 Mechanical construction

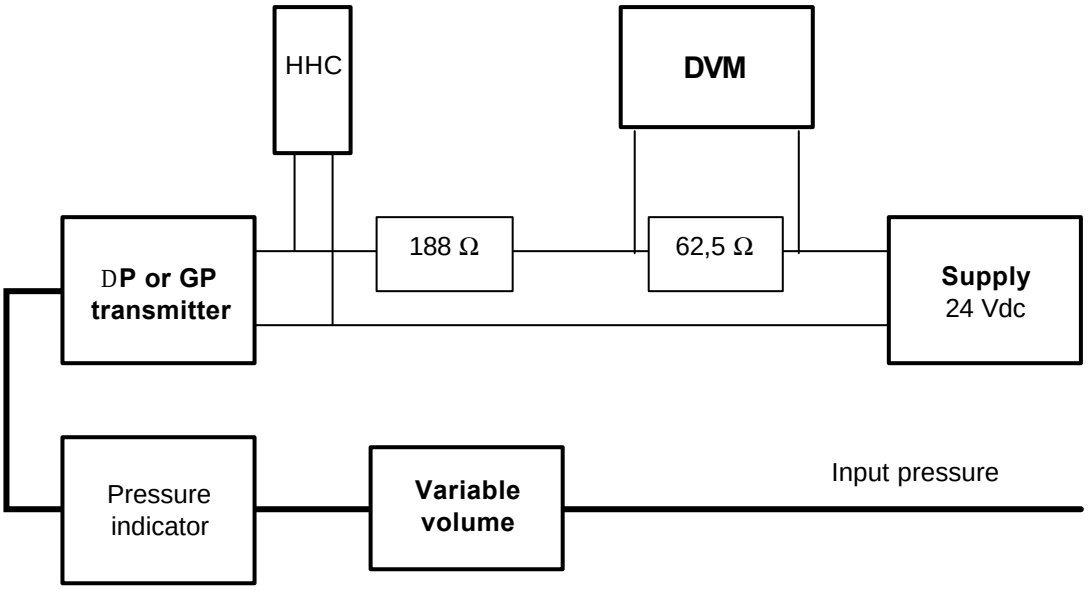
The transmitters have two major assemblies: a sensor body and an electronics housing.
The sensor body comprises the detecting unit with primary electronics for measurement of pressure, static pressure and temperature. The electronics housing comprises the transmission unit for signal conditioning and microprocessor, a module for smart communication and the terminal block. The electronics housing can turn with respect to the sensor body. The position is fixed by a screw.

The ΔP and GP transmitters are provided with mounting brackets, suitable for wall or pipe mounting. Two models are available: angle mounting bracket and flat mounting bracket. The GP transmitter is mounted on the bracket by means of a small U-bolt.

6. TEST METHODS AND REFERENCES

6.1 Test methods

6.1.1 Basic test set-up



Equipment

ΔP or P transmitter	Instrument under test: STD120, STD924, STG14L, STG94L
62,5 Ω	Resistance, 62,5 Ω ± 0,01 %; TNO-nos. 13660, 12963, 12961, 12952
188 Ω	Resistance, 188 Ω ± 1 %
Supply	HP-E3620A; dual channel, output: 24 Vdc ± 1 %
DVM	HP-3457A; TNO-nos. 10704 and 10705; uncertainty: 40 μV + 0,00035 % r.
HHC	Handheld Terminal, i.e. Honeywell, type STS103

Pressure indicators

100 mbar	Micro-manometer, Betz, TNO-no 13148, 100 mbar; uncertainty: 0,04 % P.
500...1000 mbar	Pressure standard, D&H 24610, TNO-no. 8123, range: 1,2 bar; uncertainty after calibration: 0,06 mbar + 0,005 % P, resulting in an uncertainty at a range of 500 mbar: 0,017 % and at 1000 mbar: 0,011 %.
3,5...17,5 bar	Dead-weight tester, Barnet, TNO-no. 11435, range: 30 bar; uncertainty: 0,012 % P
35 bar	Pressure standard, D&H 5502, TNO-nos. 11433, 13180, 12906, range: 200 bar; uncertainty: 0,1 mbar + 0,0001 % P

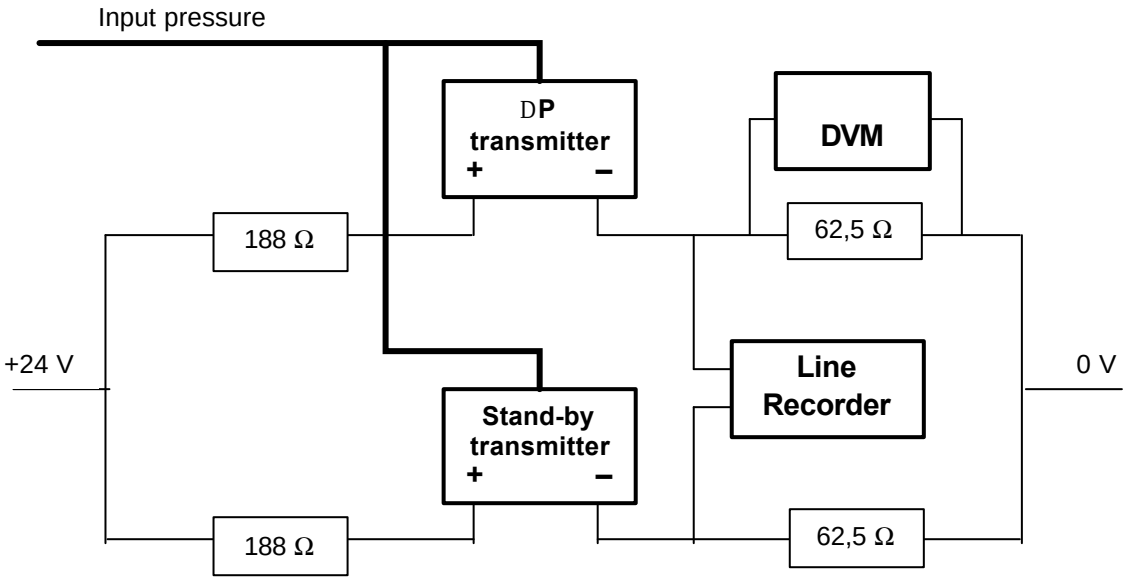
Overall uncertainty at zero (0) static pressure

100 mbar: 0,05 %, 500 mbar: 0,03 %, 1000 mbar…17 bar: 0,02 %, 35 bar: 0,015 %

Overall uncertainty at a high static pressure

Pressure standard, D&H 5502, TNO-nos. 11433, 13180, 12906, range: 200 bar, overall uncertainty of measurement of a differential pressure of 200 mbar at a static pressure of 200 bar: 0,05 %.

6.1.2 Set-up for recording the effects at 50 % input (test 11 and test 34)



Equipment

ΔP transmitter	Transmitter under test
Stand-by transmitter	Transmitter at reference conditions, identical to and receiving the same input as the transmitter under test
DVM	See basic test set-up
Line Recorder	Dual-channel, Kipp & Zonen, full scale = 1 % of span
62,5 Ω	Resistance, 62,5 Ω ± 0,01 %
188 Ω	Resistance, 188 Ω ± 1 %

6.1.3 Test schedule

For evaluation were received:

- two identical sets of STD120 instruments (ΔP), marked by the laboratory with D11 and D12,
  D11 stands for serial number 9930 S205030SD0D.
  D12 stands for serial number 9930 S206206SD0D.
- two identical sets of STD924 instruments (ΔP), marked by the laboratory with D91 and D92,
  D91 stands for serial number 9930 S192190SE0E.
  D92 stands for serial number 9930 S192189SE0E.
- one STG14L instrument (GP), marked by the laboratory with G11,
  G11 stands for serial number 9930 S194911SN2D.
- one STG94L instrument (GP), marked by the laboratory with G91,
  G91 stands for serial number 9930 S190754SN2E.

The diagram on the next page gives an overview of the tests applied and specifies the instruments subjected to the tests. The measurements carried out are marked with an 'x'. The tests are described in chapter 6.1.4 Description of the tests. The measurements and the characteristic values calculated from them are described in chapter 6.1.5 Test protocol.

Tests		Instruments				Measurements							
01…29: Standard WIB tests. 31…37: Aggravated tests.		Test for ΔP transmitter: STD120	Test for ΔP transmitter: STD924	Test for GP transmitter: STG14L	Test for GP transmitter: STG94L	I/O characteristic	Zero/span shift during/after test	Shift at 10…50…90 % input	Transient effects	A.C. component on the output	Dynamic behaviour	Qualitative observation during test	Qualitative observation after test
	STANDARD TESTS												
01	Accuracy test	D11	D91	G11	G91	x							
02	Dead band	D11	D91	G11	G91								
03	Output load	D11					x						
04	Common mode interference	D11					x			x		x	x
05	Power supply variation	D11					x						
06	Power supply interruption	D11							x			x	
07	Power supply depression	D11							x			x	x
08	Earthing	D11					x		x			x	
09	Ambient temperature	D11	D91	G11	G91	x	x	x				x	x
10	Ambient humidity	D11					x					x	x
11	One sided heat radiation	D11	D91				x						
12	Mounting position	D11		G11			x						
13	Vibration	D11		G11			x	x	x			x	x
14	Overranging	D11		G11			x						
15	Static pressure	D11	D91				x						x
18	Start-up drift	D11	D91					x					
19	Long-term drift /	D11	D91	G11	G91			x				x	
	Accelerated life test	D11	D91				x					x	x
23	Step response	D11		G11							x		
24	Frequency response	D11		G11							x		
25	Power supply reversal	D11										x	x
26	Influence of long wires	D11		G11								x	
29	Final accuracy	D11	D91	G11	G91		x	x					
	AGGRAVATED TESTS												
31	Differential temperatures	D11	D91	G11	G91		x					x	
32	Static pressure cycling	D12	D92				x						x
33	Vibration / Endurance	D11		G11			x	x	x			x	x
34	Humidity/temperature cycling	D11					x	x				x	
35	Transportation	D12					x						x
36	Hose down	D12											x
37	Salt spray	D12											x

6.1.4 Description of the tests

- Test 01…29 are Standard WIB tests. Tests 31…37 are aggravated tests.
- Unless otherwise stated, all tests are carried out at a range of 0…10 % of the Upper Range Limit (URL). The URL's are listed in chapter 4.

01 Accuracy test

The accuracy of the instrument was determined after adjustment of the span to the desired range by using the HHC and after the zero based adjustment of the input using the external zero adjustment facility. Measurements were carried out for the following ranges:

- 0...100 % of URL
- 0.....50 % of URL
- 0.....10 % of URL

The measurements were carried out three times with intervals of 10 %, for rising and falling inputs, separately. From the measurements the I/O characteristic was determined of:

- The complete instrument (pressure input versus current output).
- The input block (pressure input versus digitised input, shown on the instrument's display).
- The output block (manual output command versus current output).

02 Dead band

The Dead band was determined at 10 %, 50 % and 90 % of the three spans specified under Accuracy test.

03 Output load

The supply voltage applied was set at the allowed maximum value, i.e. 42,4 V. The load resistance was varied from 10 Ω to the maximum specified value at the maximum supply voltage, i.e. 1533 Ω.

04 Common mode interference

The test was carried out by superimposing an a.c. signal of 250 Vrms at mains frequency between earth and each output terminal independently.

05 Power supply variation

The output load was adjusted to 250 Ω. The supply voltage was varied from the lowest specified value, i.e. 16,28 V, to the maximum specified value, i.e. 42,4 V.

06 Power supply interruption

The power supply voltage was interrupted for 500 ms and the start-up time needed by the instrument to perform again within its specification was determined. Effects were determined at 100 % input.

07 Power supply depression

The power supply voltage was depressed to values between 24 V and 0 V during 5...500 ms. The load was set to the maximum value at 24 V, i.e. 600 Ω. Effects were determined at 100 % input.

08 Earthing

Each output terminal was, in turn, connected to earth.

09 Ambient temperature

The instrument was subjected to changes in ambient temperature of approx. 20 K from +20 °C to +85 °C and from +20 °C to -40 °C. The rated of change was 1/3 K/min. After a dwell time of at least 4 hours at each temperature the output was determined at 0 %, 50 % and 100 % input in upscale and downscale direction to find any increase of hysteresis. A second temperature cycle, identical to the first, was performed without readjustment of the instrument.
A final 6-point calibration in upscale direction was carried out after returning to +20 °C.
The shift at each temperature was determined of:

- The instrument: pressure input versus current output
- The input block: pressure input versus digitised output, read on the HHC.
- The output block: manual output command versus current output.

10 Ambient humidity

Test 1: The instrument was subjected to a test according to IEC68-2-3: relative humidity: 95 %, temperature: 40 °C, duration: 4 days. The instrument was switched on for the final 4 h of this period.
Test 2: The instrument was subjected to one cycle of a test according to IEC68-2-30: an increase of the temperature from 25 °C to 40 °C at a relative humidity of 95 %. Condensation occurred during temperature rise.

11 One sided heat radiation

The positive chamber (H-chamber) of the instrument was exposed to heat radiation with an intensity of 1000 W/m². The test was continued until stabilisation of the output. Then, the heat source was switched off and the measurements were continued until stabilisation. During the test the input pressure was kept constant at 0 % and the output current was continuously monitored. The test was repeated for an input of 100 %.
Both tests were repeated for heat radiation to the negative chamber (L-chamber).

12 Mounting position

The instrument was tilted through angles of ±10° and ±90° in two mutual perpendicular planes from the normal working position.

13 Vibration

The instrument was vibrated in three directions, perpendicular to the instrument's main axes, in the range of 10...500 Hz. The maximum amplitude was 0,07 mm (10...60 Hz) and the maximum acceleration was 1 g (60...500 Hz). The sweep rate was 0,5 octave/minute. During the test the input pressure was kept constant at 50 % and the output current was continuously monitored. Triaxial measurements were made on the top of the housing.

14 Overranging

The maximum overrange pressure of 210 bar was applied to the positive chamber (H-chamber) of the ΔP instrument for 1 minute. After 5 minutes recovery time at atmospheric pressure the output shift was measured. The test was repeated for the negative chamber (L-chamber).
The input for the GP transmitter was adjusted to the maximum allowed over-pressure of 50 bar.

15 Static pressure

The static pressure on both pressure chambers was increased in steps of 25 % from atmospheric to 200 bar. The zero and span shifts were measured at each step. Before the test, the span of the ΔP transmitter was adjusted to 200 mbar.

18 Start-up drift

The instrument was subjected to reference conditions for a period of 24 hours with the power supply switched off. Then, with a 0 % input signal applied to the instrument, the supply was switched on and the output was noted after 5 min and 1 hour.
The test was repeated with an input signal of 90 %.

19 Long term drift / Accelerated life test

Long term drift The instrument was operated for 30 days with a steady state input of 90 % of span. The output was measured daily. When necessary, the input was readjusted coming from the same direction. The drift was calculated from the results.
Accelerated life test The tests consisted of 4 periods of 10 days, as follows:

1st: The instrument was operated as described under Long term drift.

2nd: The instrument was connected as for normal operation and a sinusoidal input was applied with a peak-to-peak amplitude equal to half the span and centred at 50 %. The frequency was 1 Hz. The output at zero input was measured daily. At the end of this period the output at 90 % input was measured. The shift was calculated.

3rd: The instrument operated as described under Long term drift. The measurements were continued.

4th: The sinusoidal input was connected again to the instrument. The measurements were continued.

23 Step response

At least three steps between 45 % and 55 % and between 10 % and 90 % were applied upwards and downwards. The step input rise time was small compared with the transmitter response time. Both signals were recorded. Filters were set to the minimum value.

24 Frequency response

Sinusoidal input signals with a peak-to-peak amplitude equal to 10 % of span were applied and the mean value was centred at 50 %. The frequency of the input signal was increased in steps from an initial value sufficiently low to appropriate zero frequency conditions (0,005 Hz) to a higher frequency at which the output is attenuated to approximately one half of its initial amplitude. The input and output signals were recorded. During this test filters were set to the minimum value. Before the test, the span of the ΔP transmitter was adjusted to 1000 mbar.

25 Supply reversal

The effects of incorrect connection of the power supply wires were determined. After the test the instrument was inspected for damage or remaining effects.

26 Long wires

A 8-wire cable of 1000 m, type DRACODA 9100, was circuited in the parallel lines of the two field transmitters and the control room. Two HHC's were connected to the lines at the control room end of the long cable. Loss of communication and mutual influences were noted. The test was repeated after connection of the HHC's at the field end of the long cable.

29 Final accuracy

At the end of the evaluation, the instrument was re-zeroed and adjusted to the spans as listed at the Accuracy test, using the HHC. The outputs were compared with the outputs at the initial test. The span shifts were calculated.

31 Differential temperatures

The instrument was hold in a board with the transmitter electronics at the front side and the sensor part at the rear side. The board was mounted in the doorway of a climatic chamber. The transmitter electronics remain at room ambient temperature while the sensor part was subjected to temperatures of 80 °C and 110 °C. Effects at 0 % and 100 % input were measured.

32 Static pressure cycling test

A static water pressure was applied to both chambers of the instrument. The differential input pressure was 0 %. The static pressure was varied between 56 bar and 84 bar for 100.000 cycles at a frequency of approximately 15 cycles per minute. The zero shift was measured after each 25.000 cycles and after the test. The span shift was determined after the test.

33 Vibration/Endurance

Vibration The instrument was vibrated in three directions, perpendicular to the instrument's main axes, in the range of 5...500 Hz. The maximum amplitude was 3,17 mm (5...15 Hz) and the maximum acceleration was 3 g (15...500 Hz). The sweep rate was 0,5 octave/minute. During the test the input pressure was kept constant at 50 % and the output current was continuously monitored. Triaxial measurements were made on the top of the housing.

Endurance The instrument was subjected to endurance testing for 30 minutes in each of the three directions at the lowest main resonance frequency for that direction.

34 Humidity/Temperature cycling

The ambient relative humidity was kept constant at 95 % and the temperature was cycled between +10 °C an +50 °C for 6 times. The hold times were 6 hours and the ramp times were 2 hours. During the test the input pressure was kept constant at 50 % and the output current was continuously monitored.

35 Transportation test

The test was carried out according to the requirements of CES 288:52, Rev. E (1983). It consists of a combined vibration test and drop test for the packaged instruments. Before the test the instruments were re-packed in original boxes conditioned at 25 °C and 50 % relative humidity. Span shift was determined after the drop test.

1. Vibration The packed instrument was laid on the vibration table on its largest side. It was subjected to a 1,1 g vibration for one hour in the vertical plane whereby the package left the table along the longest box edge by 1,57 mm as determined by a shim. Then, the test was continued for

one hour for each of both sides, perpendicular to the first side of the box. The total duration of the test was 3 hours.
2. Drop The packaged instruments were dropped 10 times in total on edges, corners, seams and flats. The drop heights was 1 m.

36 Hose down test
The instrument was inspected for ingress of water after a hose down test according to the requirements for Class IP x6 of IEC 529.

37 Salt spray test
The instruments were subjected to a salt-spray at 35 °C for 200 hours according to NEMA ICS 6-110, Test 58 (1978).

6.1.5 Test protocol
In this chapter the measurements, carried out when applying the various tests, are summarised. From the measurements various characteristic values were calculated. The definitions of the values in *Italics characters* can be found in Chapter 6.3.

I/O characteristic
From the tests results the following characteristics were determined and presented in tabular and graphic form.
- *Average error*
- *Hysteresis error*
- *Repeatability*

Zero shift and Span shift, during the test and after the test
The *Zero shift* and *span shift* of the analogue output were determined after applying pressures of 0 % and 100 % of input span.

Shift at 10...50...90 % input
The *shift* of the analogue output was determined when applying a steady state input of either 10 %, 50 % or 90 % of the input span, as mentioned under the relevant test.

Transient effects
From the transients on the output the amplitude, polarity and duration were determined as far as possible.

A.C. component on the output
The increase of any ripple content of the output current was determined.

Dynamic behaviour
At the Step response test, the *Settling time* with a tolerance of 1 % of span was determined.
At the Frequency response test, the following parameters were determined:
- The gain, relative to zero frequency gain, against frequency.
- The phase lag between output and input against frequency.
- The frequency at which the relative was 0,7.

– The frequency at which the phase lag was 45°.

Quality observation during the test
During the test the operative behaviour of the instrument and the HHT were observed. any irregularity, caused by the test, was noted.

Quality observation after the test
After each the test the instrument was inspected for mechanical damage, damage to the electronics, accumulation of water or dust etc., which can be expected from the test.

6.2 References

IEC Publication 68 : 1982
Basic environmental testing procedures

IEC Publication 770 : 1984
Methods of evaluating the performance of transmitters for use in industrial-process control systems

IEC Publication 902 : 1987
Industrial-process measurement and control; Terms and definitions

NEMA ICS 6-110 : 1983
Test 58: Salt spray test

European Scale of Degree of rusting for Anticorrosive paints

CES 288:52, Rev. E : 1983
Transportation Effects: Vibration and Drop

The manufacturer's documentation:

34-ST-25-14A	11/98	ST 3000 Smart Transmitter, User's Manual
34-ST-03-60	11/98	ST 3000 Smart Transmitter, Series 100 Differential Pressure Models, Specification and Model Selection Guide
34-ST-03-65	11/98	ST 3000 Smart Transmitter, Series 900 Differential Pressure Models, Specification and Model Selection Guide
34-ST-03-62	11/98	ST 3000 Smart Transmitter, Series 100 Gauge Pressure Models, Specification and Model Selection Guide
34-ST-03-67	11/98	ST 3000 Smart Transmitter, Series 900 Gauge Pressure Models, Specification and Model Selection Guide
34-ST-11-14F	04/99	Smart Field Communicator, Model STS103, Operating Guide

6.3 Definitions

Reference operating conditions (IEC 902)
The operating conditions within which the influence on the device by the changes in environmental conditions are disregarded.

Error (IEC 902)
The algebraic difference between the measured value and the true value of the measured variable.
Note: The error is positive when the measured value is greater than the true value.

Average error
The arithmetic mean of the errors at each point of measurement, for rising and falling inputs separately.

Linearity, Terminal-based (IEC902)
The closeness with which the calibration curve of a device can be adjusted to approximate to the specified straight line so that the upper and lower range values of both input and output curves coincide.

Hysteresis error (IEC 902)
The maximum deviation between the two calibration curves of the measured variable as obtained by an upscale going traverse and a downscale going traverse over the full range and subtracting the value of the dead band.

Repeatability (IEC draft standard, reference 1, IEV 301, 302, 303, Sec. 1386)
The ability of a measuring instrument to provide closely similar indications for repeated applications of the same measurand under the same conditions of measurement. (In this report Repeatability is expressed as one standard deviation of the errors from the average error at each point of measurement, for rising and falling inputs separately. The standard deviation is calculated using the "nonbiased" or "n-1" method.

Resolution (IEC 902)
The least interval between two adjacent discrete details which can be distinguished one from the other. Note: In the case of an instrument with digital output, the term "resolution" is often understood as the smallest change in the output (display).

Dead band (IEC 902)
Finite range of values within which variation of the input variable does not produce any noticeable change in the output variable.
Note: For a device with digital output representation, the dead band is the smallest change in the analogue of the input signal which always causes a change in the digital output.

Shift (derived from IEC 902)
The change in output value caused by a specified influence.

Zero shift (IEC 902)
The change of the output value, due to some influences, when the input variable is at the lower range value.

Span shift (IEC 902)
The change in output span due to some influences.

Drift (IEC 902)
An undesired gradual change in the input-output relationship of a device over a period of time, not caused by external influences on the device.

Range (IEC 902)
The region of the values between the lower and upper limits of the quantity under consideration.

Span (IEC 902)
The algebraic difference between the upper and lower limit values of a given range.

Settling time (IEC 902)
Time interval between the step change of an input signal and the instant when the resulting variation of the output signal does not deviate more than a specified tolerance, for instance 5 %, from its final steady-state value. (A tolerance of 1 % of output span is used in this report.)

Uncertainty of measurement (BS 5233)
An estimate characterising the range of values within which the true value of a measurand lies. (The uncertainties quoted are for a confidence probability of not less than 95 %.)

Note:
The wording in brackets is not part of the standard. The terms underlined, such as repeatability, are used in the body of the report and are followed by the practical equivalent of the formal definition.

CERTIFICATE OF APPROVAL

This is to certify that the Quality Management System of:

Honeywell International Inc.
I.A.C. Phoenix
Phoenix, Arizona, USA

has been approved by Lloyd's Register Quality Assurance Limited to the following Quality Management System Standards:

ISO 9002:1994,
ANSI/ISO/ASQ Q9002-1994

The Quality Management System is applicable to:

Procurement, Manufacture and Integration of Industrial Automation and Control Equipment

This certificate is valid only in association with the certificate schedule bearing the same number on which the locations applicable to this approval are listed.

Approval
Certificate No: 102038

Original Approval: *January 22, 1993*

Current Certificate: *March 15, 2000*

Certificate Expiry: *January 31, 2002*

on behalf of LRQA Houston

ANSI-RAB QMS ACCREDITED

This approval is subject to the company maintaining its system to the required standards, which will be monitored by LRQA.
The use of the UKAS Accreditation Mark indicates Accreditation in respect of those activities covered by the Accreditation Certificate Number 001

Issue No. 1

CERTIFICATE SCHEDULE

Honeywell International Inc.
I.A.C. Phoenix

Office	***Activities***
Phoenix, Arizona, USA	*Procurement, Manufacture and Integration of Industrial Automation and Control Equipment*
Houston, Texas, USA	*Integration of Process Control Equipment into Functional Systems*

Approval
Certificate No: 102038

Original Approval: *January 22, 1993*

Current Certificate: *March 15, 2000*

Certificate Expiry: *January 31, 2002*

ANSI-RAB QMS ACCREDITED

This approval is subject to the company maintaining its system to the required standards, which will be monitored by LRQA.
The use of the UKAS Accreditation Mark indicates Accreditation in respect of those activities covered by the Accreditation Certificate Number 001

Issue No.

7. SECTION 2. INFORMATION

2.1 The product evaluated is also currently assembled at Phoenix Arizona USA, and Honeywell Tata, India and Tianjin China based on parts and sub assemblies sourced from Phoenix, Arizona USA. All of the parts are fully interchangeable regardless of product origin.

2.2 The typical product lifetime is 15 to 20 years.

2.3 The basic warranty is 1 year in service or 18 months from production ship date, whichever comes first and additional extended warranty of up to 5 years is offered as an option.

2.4 Spare parts, service and maintenance support is available for a minimum of 10 years after the product is withdrawn from sales.

2.5 User Manuals are available in English, French, and German.

Honeywell

ST 3000 Smart Transmitter

Series 100 Differential Pressure Models

STD110	0 to 10 inH_2O	0 to 25 mbar
STD120	0 to 400 inH_2O	0 to 1,000 mbar
STD125	0 to 600 inH_2O	0 to 1,500 mbar
STD130	0 to 100 psi	0 to 7,000 mbar
STD170	0 to 3000 psi	0 to 210,000 mbar

34-ST-03-60
11/00

Specification and Model Selection Guide

Function

Honeywell's ST 3000® Series100 Differential Pressure Transmitters bring proven "smart" technology to a wide spectrum of pressure measurement applications from furnace combustion air flow to Hydrostatic Tank Gauging. They transmit an output signal proportional to the measured variable in either an analog 4 to 20 milliampere format or in a digital DE protocol format for direct digital integration with our TDC 3000®X control system. Additional protocol options available for the ST 3000 Series 100 transmitters include FOUNDATION™ Fieldbus[1] and HART® [2]. See the Model Selection Guide for help in selecting the correct ordering code for the desired protocol.

You easily select the analog or digital transmission format through the Smart Field Communicator (SFC®) which is the common hand-held operator interface for our Smartline® Transmitters. All configuration, operation, and communications functions are under the control of the ST 3000 Smart Transmitter's micro-processor and are accessible through the SFC.

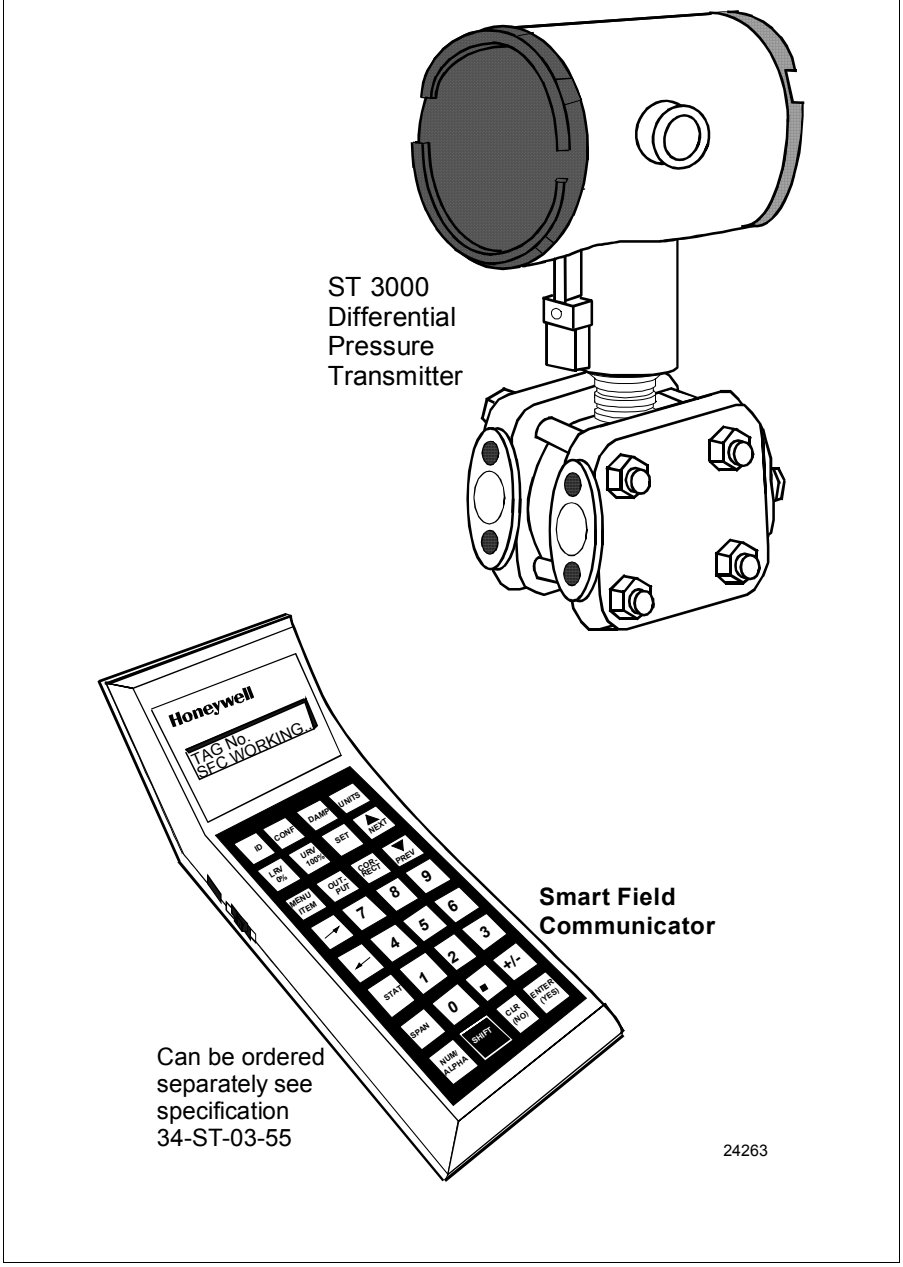


Figure 1—Series 100 Differential Pressure Transmitters feature proven "smart" technology and come in several models to meet varying application needs.

[1] FOUNDATION™ Fieldbus is a trademark of the Fieldbus Foundation.

[2] HART is a registered trademark of the Hart Communication Foundation.

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Features

- Choice of linear or square root output conformity is a simple configuration selection.
- Direct digital integration with TDC 3000^X system provides local measurement accuracy to the system level without adding typical A/D and D/A converter inaccuracies.
- Unique piezoresistive sensor automatically compensates input for temperature and static pressure.
- Added “smart” features include configuring lower and upper range values, simulating accurate analog output, and selecting preprogrammed engineering units for display.
- Smart transmitter capabilities with local or remote interfacing means significant manpower efficiency improvements in commissioning, start-up, and ongoing maintenance functions.

Description

The ST 3000 transmitter can replace any 4 to 20 milliampere output transmitter in use today, and operates over a standard two-wire system.

The measuring means is a piezoresistive sensor which actually contains three sensors in one. It contains a differential pressure sensor, a temperature sensor, and a static pressure sensor. Microprocessor-based electronics provide higher span-turndown ratio, improved temperature and pressure compensation, and improved accuracy.

Like other Smartline Transmitters, the ST 3000 features two-way communication between the operator and the transmitter through our SFC.

You can connect the SFC anywhere that you can access the transmitter signal lines, and it provides the capabilities of transmitter adjustments and diagnostics from remote locations, such as the control room.

The transmitter’s meter body and electronics housing resist shock, vibration, corrosion, and moisture. The electronics housing contains a compartment for the single-board electronics, which is isolated from an integral junction box. The single-board electronics is replaceable and interchangeable with any other ST 3000 Series 100 or Series 900 model transmitter.

Specifications

Operating Conditions – All Models

Parameter	Reference Condition		Rated Condition		Operative Limits		Transportation and Storage	
	°C	°F	°C	°F	°C	°F	°C	°F
Ambient Temperature								
STD110	25±1	77±2	-15 to 65	5 to 150	-40 to 70	-40 to 158	-40 to 70	-40 to 158
STD125	25±1	77±2	-40 to 85	-40 to 185	-40 to 85	-40 to 185	-55 to 125	-67 to 257
STD120, STD130, STD170	25±1	77±2	-40 to 85	-40 to 185	-40 to 93	-40 to 200	-55 to 125	-67 to 257
Meter Body Temperature								
STD110	25±1	77±2	-15 to 65	5 to 150	-40 to 70	-40 to 158	-40 to 70	-40 to 158
STD125	25±1	77±2	-40 to 85	-40 to 185	-40 to 85	-40 to 185	-55 to 125	-67 to 257
STD120, STD130, STD170	25±1	77±2	-40 to 110*	-40 to 230*	-40 to 125	-40 to 257	-55 to 125	-67 to 257
Humidity %RH	10 to 55		0 to 100		0 to 100		0 to 100	
Overpressure STD110 **psi** **bar**	0 0		50 3.45		50 3.45			
All Other Models **psi** **bar**	0 0		3000 210		3000 210			
Static Pressure STD110 **psi** **bar**	0 0		10 0.7		50 3.45			
Vacuum Region - Minimum Pressure All Models Except STD110 **mmHg absolute** **inH_2O absolute**	 Atmospheric Atmospheric		 25 13		 2 (short term **) 1 (short term **)			
Supply Voltage, Current, and Load Resistance	**Voltage Range:** 10.8 to 42.4 Vdc at terminals **Current Range:** 3.0 to 21.8 mA **Load Resistance:** 0 to 1440 ohms (as shown in Figure 2)							

* For CTFE fill fluid, the rating is –15 to 110°C (5 to 230°F)

** Short term equals 2 hours at 70°C (158 °F)

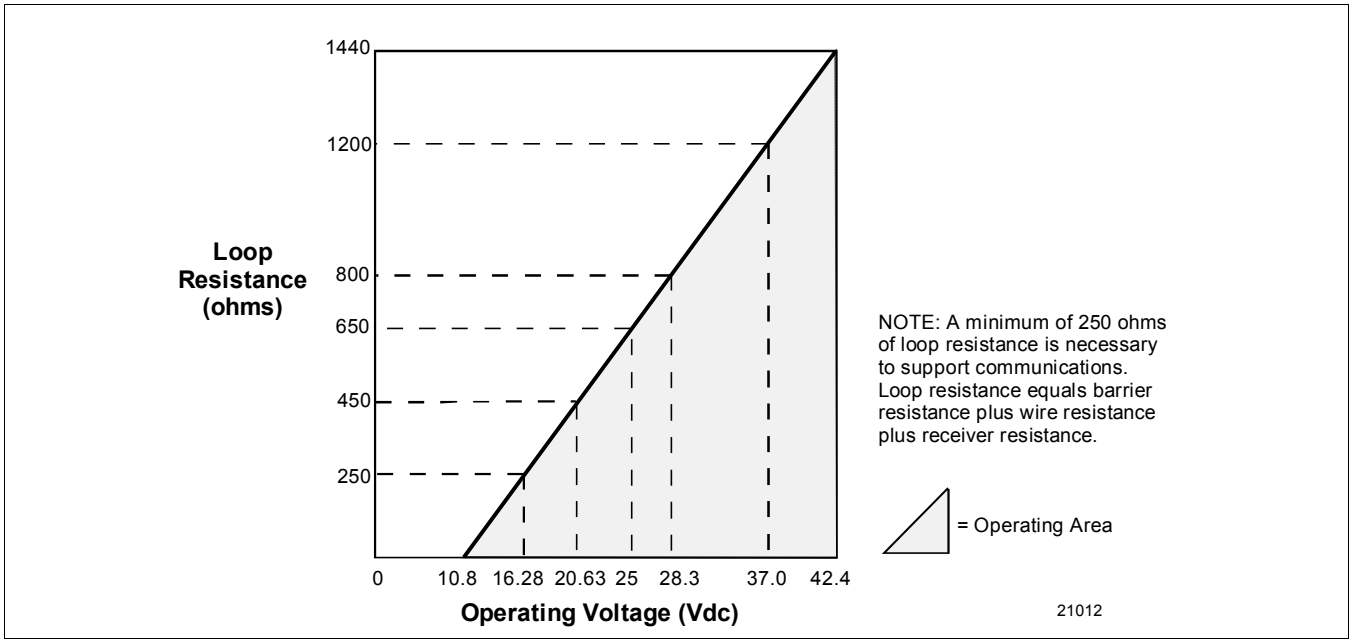

Figure 2 - Supply voltage and loop resistance chart.

Performance Under Rated Conditions* - Model STD110 (0 to 10 inH_2O)

Parameter	Description
Upper Range Limit **inH_2O** **mbar**	10 (39.2°F/4°C is standard reference temperature for inH_2O range.) 25
Minimum Span **inH_2O** **mbar**	0.4 1
Turndown Ratio	25 to 1
Zero Elevation and Suppression	No limit except minimum span within ±100% URL.
Accuracy (Reference – Includes combined effects of linearity, hysteresis, and repeatability) • *Accuracy includes residual error after averaging successive readings.* • *For FOUNDATION Fieldbus use Digital Mode specifications. For HART use Analog Mode specifications.*	**In Analog Mode:** ±0.1% of calibrated span or upper range value (URV), whichever is greater, terminal based. For URV below reference point (1.5 inH_2O), accuracy equals: $\pm 0.025 + 0.075 \left(\frac{1.5\ inH_2O}{span\ inH_2O} \right)$ or $\pm 0.025 + 0.075 \left(\frac{3.75\ mbar}{span\ mbar} \right)$ in % span **In Digital Mode:** ±0.0875% of calibrated span or upper range value (URV), whichever is greater, terminal based. For URV below reference point (1.5 inH_2O), accuracy equals: $.\pm 0.125 + 0.075 \left(\frac{1.5\ inH_2O}{span\ inH_2O} \right)$ or $\pm 0.0125 + 0.075 \left(\frac{3.75\ mbar}{span\ mbar} \right)$ in % span
Zero Temperature Effect per 28°C (50°F)	**In Analog Mode:** ±0.2625% of span. For URV below reference point (10 inH_2O), effect equals: $\pm 0.0125 + 0.25 \left(\frac{10\ inH_2O}{span\ inH_2O} \right)$ or $\pm 0.0125 + 0.25 \left(\frac{25\ mbar}{span\ mbar} \right)$ in % span **In Digital Mode:** ±0.25% of span. For URV below reference point (10 inH_2O), effect equals: $\pm 0.25 \left(\frac{10\ inH_2O}{span\ inH_2O} \right)$ or $\pm 0.25 \left(\frac{25\ mbar}{span\ mbar} \right)$ in % span
Combined Zero and Span Temperature Effect per 28°C (50°F)	**In Analog Mode:** ±0.4875% of span. For URV below reference point (10 inH_2O), effect equals: $\pm 0.2375 + 0.25 \left(\frac{10\ inH_2O}{span\ inH_2O} \right)$ or $\pm 0.2375 + 0.25 \left(\frac{25\ mbar}{span\ mbar} \right)$ in % span **In Digital Mode:** ±0.4625% of span. For URV below reference point (10 inH_2O), effect equals: $\pm 0.2125 + 0.25 \left(\frac{10\ inH_2O}{span\ inH_2O} \right)$ or $\pm 0.2125 + 0.25 \left(\frac{25\ mbar}{span\ mbar} \right)$ in % span

* Performance specifications are based on reference conditions of 25°C (77°F), zero (0) static pressure, 10 to 55% RH, and 316 Stainless Steel barrier diaphragm.

Performance Under Rated Conditions* - Model STD120 (0 to 400 inH_2O)

Parameter	Description
Upper Range Limit **inH_2O** **mbar**	400 (39.2°F/4°C is standard reference temperature for inH_2O range.) 1000
Minimum Span **inH_2O** **mbar**	1 Note: Recommended minimum span in square root mode is 20 inH_2O (50 mbar). 2.5
Turndown Ratio	400 to 1
Zero Elevation and Suppression	No limit except minimum span within ±100% URL. Specifications valid from –5 to +100% URL.
Accuracy (Reference – Includes combined effects of linearity, hysteresis, and repeatability) • *Accuracy includes residual error after averaging successive readings.* • *For FOUNDATION Fieldbus use Digital Mode specifications. For HART use Analog Mode specifications.*	**In Analog Mode:** ±0.075% of calibrated span or upper range value (URV), whichever is greater, terminal based. For URV below reference point (25 inH_2O), accuracy equals: $\pm 0.025 + 0.05 \left(\frac{25\ inH_2O}{span\ inH_2O} \right)$ or $\pm 0.025 + 0.05 \left(\frac{62\ mbar}{span\ mbar} \right)$ in % span **In Digital Mode:** ±0.0625% of calibrated span or upper range value (URV), whichever is greater, terminal based. For URV below reference point (25 inH_2O), accuracy equals: $\pm 0.0125 + 0.05 \left(\frac{25 inH_2O}{span\ inH_2O} \right)$ or $\pm 0.0125 + 0.05 \left(\frac{62\ mbar}{span\ mbar} \right)$ in % span
Zero Temperature Effect per 28°C 50°F)	**In Analog Mode:** ±0.0625% of span. For URV below reference point (50 inH_2O), effect equals: $\pm 0.0125 + 0.05 \left(\frac{50\ inH_2O}{span\ inH_2O} \right)$ or $\pm 0.0125 + 0.05 \left(\frac{125\ mbar}{span\ mbar} \right)$ in % span **In Digital Mode:** ±0.05% of span. For URV below reference point (50 inH_2O), effect equals: $\pm 0.05 \left(\frac{50\ inH_2O}{span\ inH_2O} \right)$ or $\pm 0.05 \left(\frac{125\ mbar}{span\ mbar} \right)$ in % span
Combined Zero and Span Temperature Effect per 28°C (50°F)	**In Analog Mode:** ±0.10% of span. For URV below reference point (50 inH_2O), effect equals: $\pm 0.05 + 0.05 \left(\frac{50\ inH_2O}{span\ inH_2O} \right)$ or $\pm 0.05 + 0.05 \left(\frac{125\ mbar}{span\ mbar} \right)$ in % span **In Digital Mode:** ±0.075% of span. For URV below reference point (50 inH_2O), effect equals: $\pm 0.025 + 0.05 \left(\frac{50\ inH_2O}{span\ inH_2O} \right)$ or $\pm 0.025 + 0.05 \left(\frac{125\ mbar}{span\ mbar} \right)$ in % span
Zero Static Pressure Effect per 1000 psi (70 bar)	±0.075% of span. For URV below reference point (50 inH_2O), effect equals: $\pm 0.0125 + 0.0625 \left(\frac{50\ inH_2O}{span\ inH_2O} \right)$ or $\pm 0.0125 + 0.0625 \left(\frac{125\ mbar}{span\ mbar} \right)$ in % span
Combined Zero and Span Static Pressure Effect per 1000 psi (70 bar)	±0.15% of span. For URV below reference point (50 inH_2O), effect equals: $\pm 0.0875 + 0.0625 \left(\frac{50\ inH_2O}{span\ inH_2O} \right)$ or $\pm 0.0875 + 0.0625 \left(\frac{125\ mbar}{span\ mbar} \right)$ in % span
Stability	±0.015% of URL per year

* Performance specifications are based on reference conditions of 25°C (77°F), zero (0) static pressure, 10 to 55% RH, and 316 Stainless Steel barrier diaphragm.

Performance Under Rated Conditions* - Model STD125 (0 to 600 inH_2O)

Parameter	Description
Upper Range Limit **inH_2O** **mbar**	600 (39.2°F/4°C is standard reference temperature for inH_2O range.) 1500
Minimum Span **inH_2O** **mbar**	25 62.2
Turndown Ratio	24 to 1
Zero Elevation and Suppression	No limit except minimum span within 0 to 100% URL.
Accuracy (Reference – Includes combined effects of linearity, hysteresis, and repeatability) • *Accuracy includes residual error after averaging successive readings.* • *For FOUNDATION Fieldbus use Digital Mode specifications. For HART use Analog Mode specifications.*	**In Analog Mode:** ±0.075% of calibrated span or upper range value (URV), whichever is greater, terminal based. For URV below reference point (25 inH_2O), accuracy equals: $\pm 0.0375 + 0.0375 \left(\frac{25\ inH_2O}{span\ inH_2O}\right)$ or $\pm 0.0375 + 0.0375 \left(\frac{62\ mbar}{span\ mbar}\right)$ in % span **In Digital Mode:** ±0.05% of calibrated span or upper range value (URV), whichever is greater, terminal based. For URV below reference point (25 inH_2O), accuracy equals: $\pm 0.0125 + 0.0375 \left(\frac{25 inH_2O}{span\ inH_2O}\right)$ or $\pm 0.0125 + 0.0375 \left(\frac{62\ mbar}{span\ mbar}\right)$ in % span
Zero Temperature Effect per 28°C (50°F)	**In Analog Mode:** ±0.0625% of span. For URV below reference point (50 inH_2O), effect equals: $\pm 0.0125 + 0.05 \left(\frac{50\ inH_2O}{span\ inH_2O}\right)$ or $\pm 0.0125 + 0.05 \left(\frac{125\ mbar}{span\ mbar}\right)$ in % span **In Digital Mode:** ±0.05% of span. For URV below reference point (50 inH_2O), effect equals: $\pm 0.05 \left(\frac{50\ inH_2O}{span\ inH_2O}\right)$ or $\pm 0.05 \left(\frac{125\ mbar}{span\ mbar}\right)$ in % span
Combined Zero and Span Temperature Effect per 28°C (50°F)	**In Analog Mode:** ±0.10% of span. For URV below reference point (50 inH_2O), effect equals: $\pm 0.05 + 0.05 \left(\frac{50\ inH_2O}{span\ inH_2O}\right)$ or $\pm 0.05 + 0.05 \left(\frac{125\ mbar}{span\ mbar}\right)$ in % span **In Digital Mode:** ±0.075% of span. For URV below reference point (50 inH_2O), effect equals: $\pm 0.025 + 0.05 \left(\frac{50\ inH_2O}{span\ inH_2O}\right)$ or $\pm 0.025 + 0.05 \left(\frac{125\ mbar}{span\ mbar}\right)$ in % span
Zero Static Pressure Effect per 1000 psi (70 bar)	±0.075% of span. For URV below reference point (50 inH_2O), effect equals: $\pm 0.0125 + 0.0625 \left(\frac{50\ inH_2O}{span\ inH_2O}\right)$ or $\pm 0.0125 + 0.0625 \left(\frac{125\ mbar}{span\ mbar}\right)$ in % span
Combined Zero and Span Static Pressure Effect per 1000 psi (70 bar)	±0.20% of span. For URV below reference point (50 inH_2O), effect equals: $\pm 0.1375 + 0.0625 \left(\frac{50\ inH_2O}{span\ inH_2O}\right)$ or $\pm 0.1375 + 0.0625 \left(\frac{125\ mbar}{span\ mbar}\right)$ in % span
Stability	**In Analog Mode:** ±0.015% URL per year

* Performance specifications are based on reference conditions of 25°C (77°F), zero (0) static pressure, 10 to 55% RH, and 316 Stainless Steel barrier diaphragm.

Performance Under Rated Conditions* - Model STD130 (0 to 100 psi)

Parameter	Description
Upper Range Limit **psi** **bar**	100 7
Minimum Span **psi** **bar**	5 0.35
Turndown Ratio	20 to 1
Zero Elevation and Suppression	No limit except minimum span within –18 and +100% URL. Specifications valid from –5 to +100% URL.
Accuracy (Reference – Includes combined effects of linearity, hysteresis, and repeatability) • *Accuracy includes residual error after averaging successive readings.* • *For FOUNDATION Fieldbus use Digital Mode specifications. For HART use Analog Mode specifications.*	**In Analog Mode:** ±0.075% of calibrated span or upper range value (URV), whichever is greater, terminal based. For URV below reference point (15 psi), accuracy equals: $\pm 0.025 + 0.05 \left(\frac{15 \text{ psi}}{\text{span psi}}\right)$ or $\pm 0.025 + 0.05 \left(\frac{1 \text{ bar}}{\text{span bar}}\right)$ in % span **In Digital Mode:** ±0.0625% of calibrated span or upper range value (URV), whichever is greater, terminal based. For URV below reference point (15 psi), accuracy equals: $\pm 0.0125 + 0.05 \left(\frac{15 \text{ psi}}{\text{span psi}}\right)$ or $\pm 0.0125 + 0.05 \left(\frac{1 \text{ bar}}{\text{span bar}}\right)$ in % span
Zero Temperature Effect per 28°C (50°F)	**In Analog Mode:** ±0.0625% of span. For URV below reference point (30 psi), effect equals: $\pm 0.0125 + 0.05 \left(\frac{30 \text{ psi}}{\text{span psi}}\right)$ or $\pm 0.0125 + 0.05 \left(\frac{2 \text{ bar}}{\text{span bar}}\right)$ in % span **In Digital Mode:** ±0.05% of span. For URV below reference point (30 psi), effect equals: $\pm 0.05 \left(\frac{30 \text{ psi}}{\text{span psi}}\right)$ or $\pm 0.05 \left(\frac{2 \text{ bar}}{\text{span bar}}\right)$ in % span
Combined Zero and Span Temperature Effect per 28°C (50°F)	**In Analog Mode:** ±0.10% of span. For URV below reference point (30 psi), effect equals: $\pm 0.05 + 0.05 \left(\frac{30 \text{ psi}}{\text{span psi}}\right)$ or $\pm 0.05 + 0.05 \left(\frac{2 \text{ bar}}{\text{span bar}}\right)$ in % span **In Digital Mode:** ±0.075% of span. For URV below reference point (30 psi), effect equals: $\pm 0.025 + 0.05 \left(\frac{30 \text{ psi}}{\text{span psi}}\right)$ or $\pm 0.025 + 0.05 \left(\frac{2 \text{ bar}}{\text{span bar}}\right)$ in % span
Zero Static Pressure Effect per 1000 psi (70 bar)	±0.075% of span. For URV below reference point (30 psi), effect equals: $\pm 0.0125 + 0.0625 \left(\frac{30 \text{ psi}}{\text{span psi}}\right)$ or $\pm 0.0125 + 0.0625 \left(\frac{2 \text{ bar}}{\text{span bar}}\right)$ in % span
Combined Zero and Span Static Pressure Effect per 1000 psi (70 bar)	±0.15% of span. For URV below reference point (30 psi), effect equals: $\pm 0.0875 + 0.0625 \left(\frac{30 \text{ psi}}{\text{span psi}}\right)$ or $\pm 0.0875 + 0.0625 \left(\frac{2 \text{ bar}}{\text{span bar}}\right)$ in % span
Stability	±0.04% of URL per year.

* Performance specifications are based on reference conditions of 25°C (77°F), zero (0) static pressure, 10 to 55% RH, and 316 Stainless Steel barrier diaphragm.

Performance Under Rated Conditions* - Model STD170 (0 to 3000 psi)

Parameter	Description
Upper Range Limit **psi** **bar**	3000 210
Minimum Span **psi** **bar**	100 7
Turndown Ratio	30 to 1
Zero Elevation and Suppression	No limit except minimum span within –0.6 and +100% URL. Specifications valid over this range.
Accuracy (Reference – Includes combined effects of linearity, hysteresis, and repeatability) • *Accuracy includes residual error after averaging successive readings.* • *For FOUNDATION Fieldbus use Digital Mode specifications. For HART use Analog Mode specifications.*	**In Analog Mode:** ±0.15% of calibrated span or upper range value (URV), whichever is greater, terminal based. For URV below reference point (300 psi), accuracy equals: $\pm 0.05 + 0.10 \left(\frac{300 \text{ psi}}{\text{span psi}} \right)$ or $\pm 0.05 + 0.10 \left(\frac{21 \text{ bar}}{\text{span bar}} \right)$ in % span **In Digital Mode:** ±0.125% of calibrated span or upper range value (URV), whichever is greater, terminal based. For URV below reference point (300 psi), accuracy equals: $\pm 0.025 + 0.10 \left(\frac{300 \text{ psi}}{\text{span psi}} \right)$ or $\pm 0.025 + 0.10 \left(\frac{21 \text{ bar}}{\text{span bar}} \right)$ in % span
Zero Temperature Effect per 28°C (50°F)	**In Analog Mode:** ±0.1125% of span. For URV below reference point (500 psi), effect equals: $\pm 0.0125 + 0.10 \left(\frac{500 \text{ psi}}{\text{span psi}} \right)$ or $\pm 0.0125 + 0.10 \left(\frac{35 \text{ bar}}{\text{span bar}} \right)$ in % span **In Digital Mode:** ±0.10% of span. For URV below reference point (500 psi), effect equals: $\pm 0.10 \left(\frac{500 \text{ psi}}{\text{span psi}} \right)$ or $\pm 0.10 \left(\frac{35 \text{ bar}}{\text{span bar}} \right)$ in % span
Combined Zero and Span Temperature Effect per 28°C (50°F)	**In Analog Mode:** ±0.175% of span. For URV below reference point (500 psi), effect equals: $\pm 0.075 + 0.10 \left(\frac{500 \text{ psi}}{\text{span psi}} \right)$ or $\pm 0.075 + 0.10 \left(\frac{35 \text{ bar}}{\text{span bar}} \right)$ in % span **In Digital Mode:** ±0.15% of span. For URV below reference point (500 psi), effect equals: $\pm 0.05 + 0.10 \left(\frac{500 \text{ psi}}{\text{span psi}} \right)$ or $\pm 0.05 + 0.10 \left(\frac{35 \text{ bar}}{\text{span bar}} \right)$ in % span
Zero Static Pressure Effect per 1000 psi (70 bar)	±0.075% of span. For URV below reference point (500 psi), effect equals: $\pm 0.0125 + 0.0625 \left(\frac{500 \text{ psi}}{\text{span psi}} \right)$ or $\pm 0.0125 + 0.0625 \left(\frac{35 \text{ bar}}{\text{span bar}} \right)$ in % span
Combined Zero and Span Static Pressure Effect per 1000 psi (70 bar)	±0.15% of span. For URV below reference point (500 psi), effect equals: $\pm 0.0875 + 0.0625 \left(\frac{500 \text{ psi}}{\text{span psi}} \right)$ or $\pm 0.0875 + 0.0625 \left(\frac{35 \text{ bar}}{\text{span bar}} \right)$ in % span
Stability	±0.03% of URL per year.

* Performance specifications are based on reference conditions of 25°C (77°F), zero (0) static pressure, 10 to 55% RH, and 316 Stainless Steel barrier diaphragm.

Performance Under Rated Conditions - General for all Models

Parameter	Description
Output (two-wire)	Analog 4 to 20 mA or digital communications DE mode. Options available for FOUNDATION Fieldbus and HART protocol.
Supply Voltage Effect	0.005% span per volt.
Damping Time Constant	Adjustable from 0 to 32 seconds digital damping.
CE Conformity (Europe)	89/336/EEC, Electromagnetic Compatibility (EMC) Directive.
Lightning Protection Option (Code "LP")	Leakage Current: 10 microamps max. @ 42.4 VDC, 93°C Impulse Rating: (rise/decay) 10/20 µ sec. 5,000 Amps (50 strikes) 10,000 Amps (20 strikes) 10/1000 µ sec. 250 Amps (1000 strikes) 500 Amps (400 strikes)

Physical and Approval Bodies

Parameter	Description
Barrier Diaphragms Material	
STD125, STD110	316L SS
STD120, STD130	316L SS, Hastelloy C-276, Monel, Tantalum
STD170	316L SS, Hastelloy C-276
Process Head Material	
STD125, STD110	316 SS, Carbon Steel (Zinc-plated)
STD120, STD130	316 SS, Carbon Steel (Zinc-plated), Monel, Hastelloy C-276
STD170	316 SS, Carbon Steel (Zinc-plated), Hastelloy C-276
Head Gaskets	Teflon, Viton
Meter Body Bolting	Carbon Steel (Zinc plated, standard) or A286 SS (NACE) bolts and 302/304 SS (NACE) nuts for heads and 316 SS (NACE) bolts for adapters (standard option).
Mounting Bracket	Carbon Steel (Zinc-plated) or Stainless Steel angle bracket or Carbon Steel flat bracket available (standard options).
Fill Fluid	Silicone DC 200 oil or CTFE (Chlorotrifluoroethylene). Note that Model STD110 is only available with silicone fill fluid.
Electronic Housing	Epoxy-Polyester hybrid paint. Low Copper-Aluminum. Meets NEMA 4X (watertight) and NEMA 7 (explosion proof). Stainless steel optional.
Process Connections	1/4-inch NPT; 1/2-inch NPT with adapter (standard option); DIN (standard option).
Wiring	Accepts up to 16 AWG (1.5 mm diameter).
Mounting	Can be mounted in virtually any position using the standard mounting bracket. Bracket is designed to mount on 2-inch (50 mm) vertical or horizontal pipe. See Figure 3.
Dimensions	See Figure 4.
Net Weight	12.5 pounds (5.6 Kg)
Approval Bodies	Approved as explosion proof and intrinsically safe for use in Class I, Division 1, Groups A, B, C, D locations, and nonincendive for Class I, Division 2, Groups A, B, C, D locations. Approved EEx ia IIC T5 and EEx d IIC T6 per CENELEC standards; and Ex N II T5 per BS 6941.

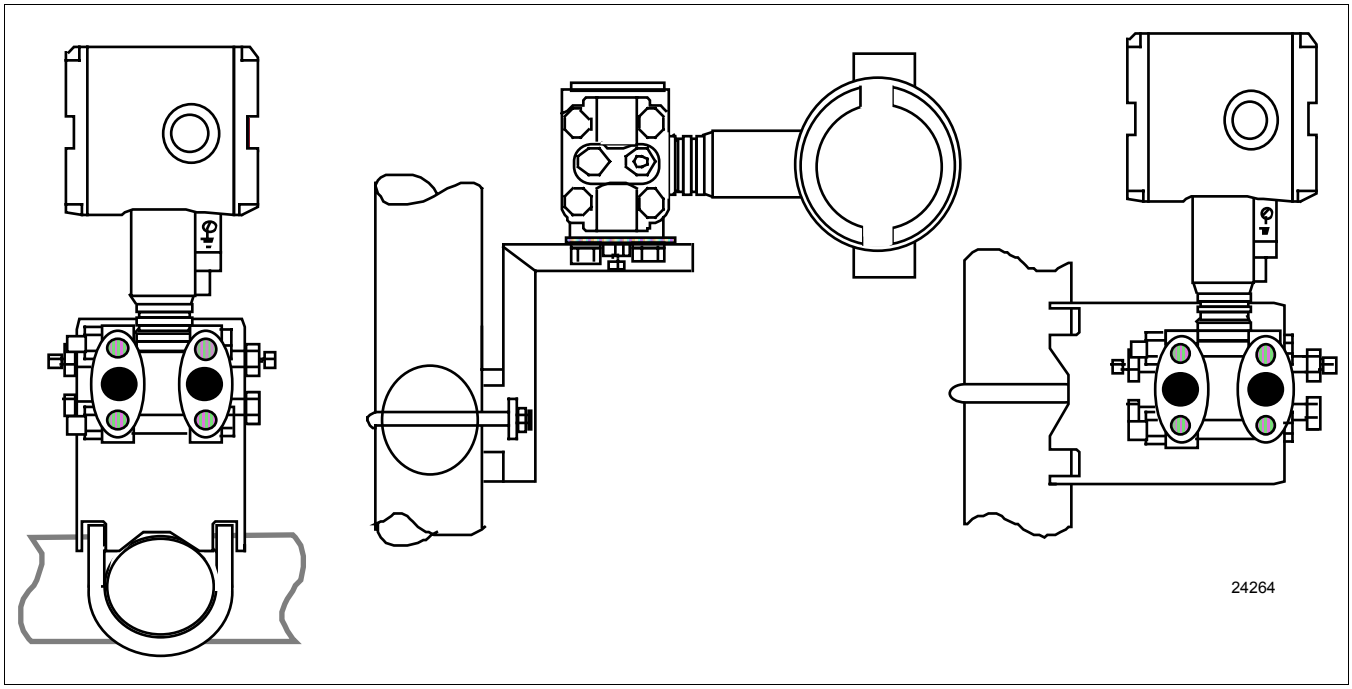

Figure 3 - Examples of typical mounting positions

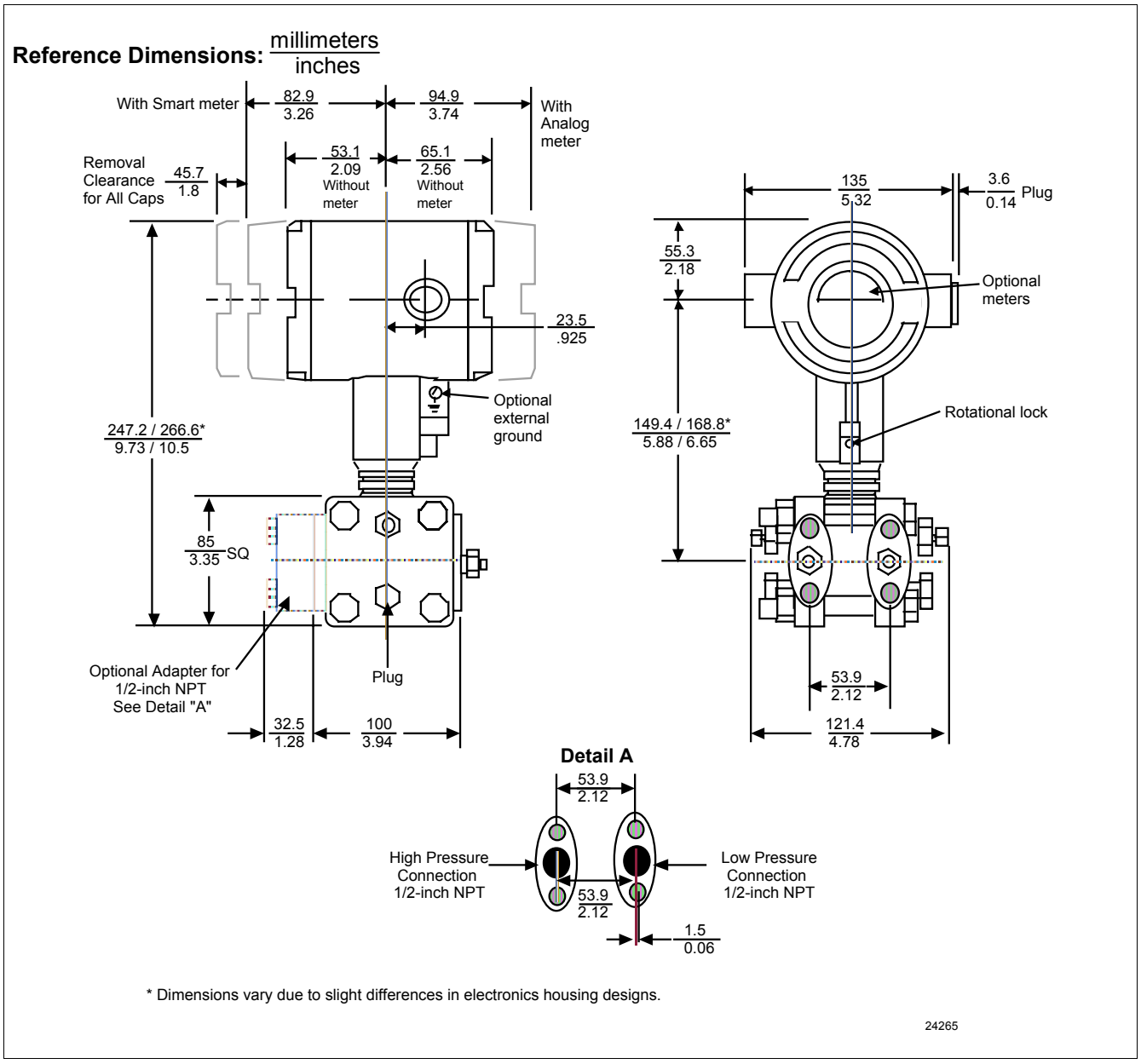

Figure 4 - Typical mounting dimensions for reference

Options

Mounting Bracket
The angle mounting bracket is available in either zinc-plated carbon steel or stainless steel and is suitable for horizontal or vertical mounting on a two inch (50 millimeter) pipe, as well as wall mounting. An optional flat mounting bracket is also available in carbon steel for two inch (50 millimeter) pipe mounting.

Indicating Meter
Two integral meter options are available. An analog meter (option ME) is available with a dual 0 to 10 square root and 0 to 100% linear scale. The Smart Meter (option SM) provides an LCD display for both analog and digital output and can be configured to display pressure in selected engineering units.

HART Protocol Compatibility (Option HC)
An optional electronics module is available for the Series 100 that provides HART Protocol compatibility. Transmitters with the HART Option are compatible with the AMS System. (Contact your AMS Supplier if an upgrade is required.)

Lightning Protection
A terminal block is available with circuitry that protects the transmitter from transient surges induced by nearby lightning strikes.

Tagging (Option TG)
Up to 30 characters can be added on the stainless steel nameplate mounted on the transmitter's electronics housing at no extra cost. Note that a separate nameplate on the meter body contains the serial number and body-related data. A stainless steel wired on tag with additional data of up to 4 lines of 28 characters is also available. The number of characters for tagging includes spaces.

Transmitter Configuration (Option TC)
The factory can configure the transmitter linear/square root extraction, damping time, LRV, URV and mode (analog/digital) and enter an ID tag of up to eight characters and scratchpad information as specified.

Custom Calibration and ID in Memory (Option CC)
The factory can calibrate any range within the scope of the transmitter's range and enter an ID tag of up to eight characters in the transmitter's memory.

FOUNDATION Fieldbus (Option FF)
Equips transmitter with FF protocol for use in 31.25 kbit/s FF networks. See document 34-ST-03-72 for additional information on ST 3000 Fieldbus transmitters.

Specifications are subject to change without notice.

Ordering Information

Contact your nearest Honeywell sales office, or

In the U.S.:
Honeywell
Industrial Automation & Control
16404 North Black Canyon Hwy.
Phoenix, AZ 85053
1-800-288-7491

In Canada:
The Honeywell Centre
155 Gordon Baker Rd.
North York, Ontario M2H 3N7
1-800-461-0013

In Latin America:
Honeywell Inc.
480 Sawgrass Corporate Parkway,
Suite 200
Sunrise, FL 33325
(954) 845-2600

In Europe and Africa:
Honeywell S. A.
Avenue du Bourget 1
1140 Brussels, Belgium
[32-2] 728-2111

In Eastern Europe:
Honeywell Praha,
s.r.o. Budejovicka 1
140 21 Prague 4,
Czech Republic

In the Middle East:
Honeywell Middle East Ltd.
Khalifa Street,
Sheikh Faisal Building
Abu Dhabi, U. A. E.

In Asia:
Honeywell Asia Pacific Inc.
Honeywell Building,
17 Changi Business Park Central 1
Singapore 486073
Republic of Singapore

In the Pacific:
Honeywell Pty Ltd.
5 Thomas Holt Drive
North Ryde NSW Australia 2113
(61 2) 9353 7000

In Japan:
Honeywell K.K.
14-6 Shibaura 1-chrome
Minato-ku, Tokyo, Japan 105-0023

Or, visit Honeywell on the World Wide Web at: **http://www.honeywell.com**

Model Selection Guide

34-ST-16-01

Instructions

- Select the desired Key Number. The arrow to the right marks the selection available.
- Make one selection from each Table I and II using the column below the proper arrow.
- Select as many Table III options as desired (if no options are desired, specify 00). A dot (•) denotes unrestricted availability. A letter denotes restricted availability. Restrictions follow Table IV.

Key Number		I		II		III (Optional)		IV
_ _ _ _ _ _	-	_ _ _	-	_ _ _ _ _ _	-	_ _, _ _	+	XXXX

KEY NUMBER

Span	Selection	Availability				
0-1" to 0-400" H_2O/0-2.5 to 0-1000 mbar	STD120	↓				
Body Rating: 3000 psi (210 bar)						
0-5 to 0-100 psi/0-0.35 to 0-7 bar	STD130		↓			
Body Rating: 3000 psi (210 bar)						
0-100 to 0-3000 psi/0-7 to 0-210 bar	STD170			↓		
Body Rating: 3000 psi (210 bar)						
0-25" to 0-600" H_2O/0-62.2 to 0-1500 mbar	STD125				↓	
Body Rating: 3000 psi (210 bar)						
0-0.4" to 0-10" H_2O/0-1 to 0-25 mbar	STD110					↓
Body Rating: 50 psi (3.5 bar) Compound Characterized						

TABLE I - METER BODY

	Wetted Process Heads	Vent/Drain Valves ** and Plugs	Barrier Diaphragms						
	Carbon Steel *	316 St. St.	316 LSS	A _ _	•	•	•	•	•
	Carbon Steel *	316 St. St.	Hastelloy C	B _ _	•	•	•		
	Carbon Steel *	316 St. St.	Monel	C _ _	•	•			
Material	Carbon Steel *	316 St. St.	Tantalum	D _ _	•	•			
of	316 St. St.	316 St. St.	316 LSS	E _ _	•	•	•	•	•
Construction	316 St. St.	316 St. St.	Hastelloy C	F _ _	•	•	•		
	316 St. St.	316 St. St.	Monel	G _ _	•	•			
	316 St. St.	316 St. St.	Tantalum	H _ _	•	•			
	Hastelloy C	Hastelloy C	Hastelloy C	J _ _	v	v	v		
	Hastelloy C	Hastelloy C	Tantalum	K _ _	v	v			
	Monel	Monel	Monel	L _ _	v	v			
Fill Fluid	Silicone			_ 1 _	•	•	•	•	•
	CTFE			_ 2 _	•	•	•		
Process Head	1/4" NPT			_ _ A	•	•	•	•	•
Configuration	1/2" NPT with Adapter (on 1/4" NPT Head)			_ _ H	t	t	t	t	t

* Carbon Steel heads are zinc-plated. Not recommended for water service due to hydrogen migration. Use Stainless Steel heads.

** Vent/Drains are Teflon coated for lubricity.

Model Selection Guide, continued

TABLE II	Selection	STD1 Availability 20	30	70	25	10
No Selection	00000	•	•	•	•	•

TABLE III - OPTIONS

None	00	•	•	•	•	•	
Adapter Flange - 1/2" NPT St. Steel	S2	c	c	c	c	c	
Adapter Flange - 1/2" NPT Hastelloy-C	T2	c	c	c			b
Adapter Flange - 1/2" NPT Monel	V2	c	c	c			
Modified DIN Process Heads - 316SS	DN	w	w	w	w	w	
316 ST.ST. Electronics Housing with M20 Conduit Connections	SH	n	n	n	n	n	
1/2" NPT to M20 316SS Conduit Adapter (BASEEFA EEx d IIC)	A1	n	n	n	n	n	b
1/2" NPT to 3/4" NPT 316 SS Conduit Adapter	A2	u	u	u	u	u	
Viton Head Gaskets (1/2" adapter gaskets are special)	VT	•	z	z	•	•	
Mounting Bracket - Carbon Steel	MB	•	•	•	•	•	
Mounting Bracket - ST. ST.	SB	•	•	•	•	•	b
Flat Mounting Bracket - Carbon Steel	FB	•	•	•	•	•	
Lightning Protection	LP	•	•	•	•	•	
Analog Meter (0-100 Even 0-10 Square Root)	ME	•	•	•	•	•	b
Smart Meter	SM	•	•	•	•	•	
Custom Calibration and I.D. in Memory	CC	•	•	•	•	•	
Transmitter Configuration - non-Fieldbus	TC	•	•	•	•	•	b
Transmitter Configuration - Fieldbus	FC	a	a	a	a	a	
Write Protection	WP	•	•	•	•	•	
A286SS (NACE) Bolts and 302/304SS (NACE) Nuts for Heads and 316SS (NACE) Bolts for Adapters	CR	•	•	•	•	•	
Stainless Steel Customer Wired-On Tag (4 lines, 28 characters per line, customer supplied information)	TG	•	•	•	•	•	
Stainless Steel Customer Wired-On Tag (blank)	TB	•	•	•	•	•	
Additional Warranty - 1 year	W1	•	•	•	•	•	
Additional Warranty - 2 years	W2	•	•	•	•	•	
Additional Warranty - 3 years	W3	•	•	•	•	•	b
Additional Warranty - 4 years	W4	•	•	•	•	•	
Clean Transmitter for Oxygen or Chlorine Service with Certificate	0X	j	j	j			
Over-Pressure Leak Test with F3392 Certificate	TP	•	•	•	•	•	
Side Vent/Drain (End Vent Drain is standard)	SV	g	g	g	g		
SS Center Vent Drain and Bushing	CV	g	g	g	g	g	b
Blind DIN SS Flanges Mounted with NACE Bolts	B2	d	d	d	d	d	
Calibration Test Report and Certificate of Conformance (F3399)	F1	•	•	•	•	•	b
Certificate of Conformance (F3391)	F3	•	•	•	•	•	
Certificate of Origin (F0195)	F5	•	•	•	•	•	
NACE Certificate (F0198)	F7	o	o	o	o	o	
FOUNDATION Fieldbus Communications	FF	r	r	r	r	r	b
HART Protocol compatible electronics	HC	e	e	e	e	e	
Local Zero & Span	ZS	m	m	m	m		b
Local Zero	LZ	x	x	x	x		

Model Selection Guide, continued

TABLE III - OPTIONS (continued)

Approval Body	Approval Type	Location or Classification	Selection	Availability STD1 20	30	70	25	10
No hazardous location approvals			9X	•	•	•	•	•
Factory Mutual	Explosion Proof	Class I, Div. 1, Groups A,B,C,D	1C	•	•	•	•	•
	Dust Ignition Proof	Class II, III Div. 1, Groups E,F,G						
	Non-Incendive	Class I, Div. 2, Groups A,B,C,D						
	Intrinsically Safe	Class I, II, III, Div. 1, Groups A,B,C,D,E,F,G						
CSA	Explosion Proof	Class I, Div. 1, Groups B,C,D	2J	•	•	•	•	•
	Dust Ignition Proof	Class II, III, Div. 1, Groups E,F,G						
	Intrinsically Safe	Class I, II, III, Div. 1, Groups A,B,C,D,E,F,G						
Zone 2 (Europe)	Self-Declared per 94/9/EC (ATEX4)	Ex II 3 GD T (1) X (1) T4 at Tamb. 93°C, T5 at Tamb. 80°C, T6 at Tamb. 65°C	3N	•	•	•	•	•
SA (Australia)	Intrinsically Safe	Ex ia IIC T4	4H	a	a	a	a	a
	Non-Incendive	Ex n IIC T6 (T4 with SM option)						
	Flame Proof	Ex d IIC T6						
LCIE CENELEC	Flame Proof	EEx d IIC T6	3A	•	h	•	•	•
	Intrinsically Safe	EEx ia IIC T5						
	Flame Proof	EEx d IIC T6	3D	•	h	•	•	•
	Intrinsically Safe	EEx ia IIC T5	3S		p			

b

TABLE IV

Factory Identification	XXXX	•	•	•	•	•

Model Selection Guide, continued

RESTRICTIONS

Restriction		Available Only With		Not Available With
Letter	**Table**	**Selection**	**Table**	**Selection**
a	Pending			
b	Select only one option from this group			
c	I	_ _ H		
d	III	DN		
e	III	1C, 2J, 3N, 3D, 9X		
g			I	J _ _, K _ _, L _ _ includes side vent - no price add
h			I	C _ _, G _ _, L _ _
j	I	_ 2 _		
m			III	ME, FF
n			III	1C, 2J
o	III	CR or B2		
p	I	C _ _, G _ _, L _ _		
r			III	TC, ME
t	III	S2, T2, V2		
u	III	1C, 2J		
v	Includes side vent drain - no price add		III	SV
w	I	E _ A, F _ A, G _ A, H _ A	III	SV
x	III	FF, SM		
z			I	B _ _, D _ _, F _ _, H _ _, J _ _, K _ _

Note: See 13:ST-27 for Published Specials with pricing.
See 13:ST-29 and User's Manual for part numbers.
See 13:ST-OE-9 for OMS Order Entry Information including TC, manuals, certificates, drawings and SPINS.
See 13:ST-OD-1 for tagging, ID, Transmitter Configuration (TC) and calibration including factory default values.
To request a quotation for a non-published "special", fax RFQ to Marketing Applications.

Honeywell

Industrial Automation and Control
Honeywell Inc.
16404 North Black Canyon Highway
Phoenix, Arizona 85023-3099

Honeywell

ST 3000 Smart Transmitter
Series 900 Differential Pressure Models

STD924	0 to 400 inH_2O	0 to 1,000 mbar
STD930	0 to 100 psi	0 to 7,000 mbar
STD974	0 to 3000 psi	0 to 210,000 mbar

34-ST-03-65
10/99

Specification and Model Selection Guide

Function

Honeywell's ST 3000® Series 900 Differential Pressure Transmitters bring proven "smart" technology to a wide spectrum of pressure measurement applications including flow and liquid level. They transmit an output signal proportional to the measured variable in either an analog 4 to 20 milliampere format or in a digital DE protocol format for direct digital integration with our TDC 3000®X control system. Additional protocol options available for the ST 3000 Series 900 transmitters include FOUNDATION™ Fieldbus[1] and HART® [2]. See the Model Selection Guide for help in selecting the correct ordering code for the desired protocol.

In the standard transmitter you easily select the analog or digital transmission format through the Smart Field Communicator (SFC®) which is the common hand-held operator interface for our DE-based Smartline® Transmitters. All configuration, operation, and communications functions are under the control of the ST 3000 Smart Transmitter's microprocessor and are accessible through the SFC.

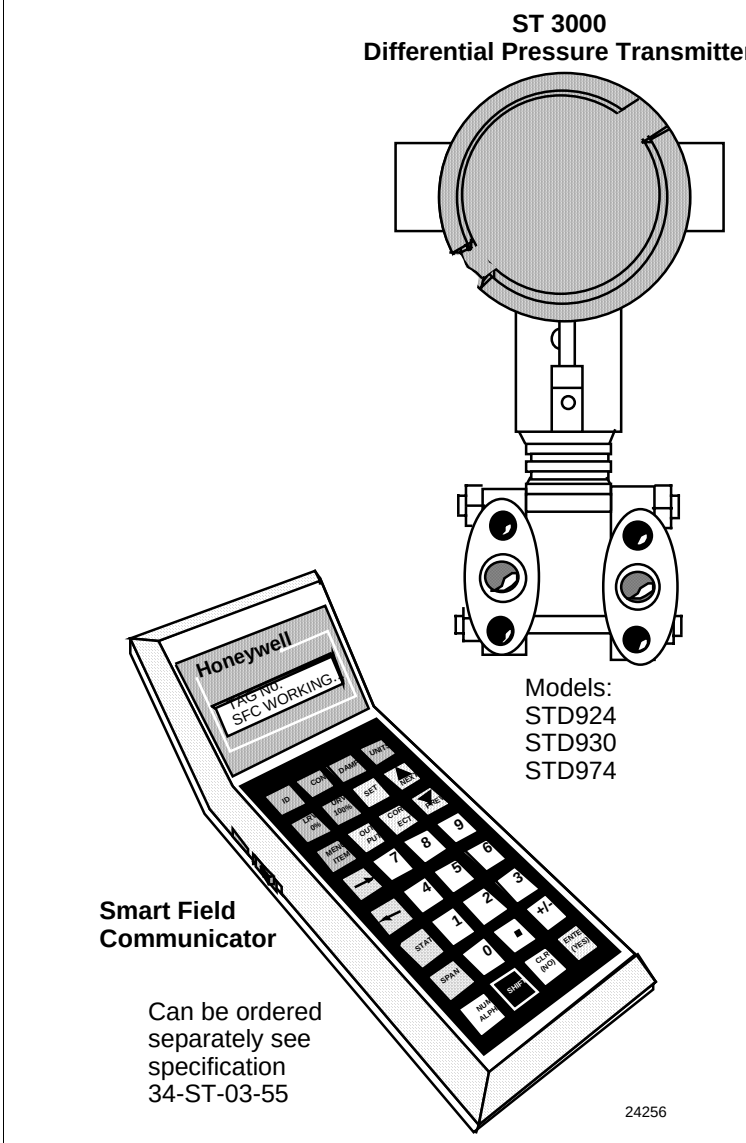

Figure 1 —Series 900 Differential Pressure Transmitters feature proven "smart" technology and come in several models to meet varying application needs.

[1] FOUNDATION™ Fieldbus is a trademark of the Fieldbus Foundation.

[2] HART is a registered trademark of the Hart Communication Foundation

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Features

- Choice of linear or square root output conformity is a simple configuration selection.
- Direct digital integration with TDC 3000^X system provides local measurement accuracy to the system level without adding typical A/D and D/A converter inaccuracies.
- Unique piezoresistive sensor automatically compensates input for temperature and static pressure.
- Added “smart” features include configuring lower and upper range values, simulating accurate analog output, and selecting preprogrammed engineering units for display.
- Smart transmitter capabilities with local or remote interfacing means significant manpower efficiency improvements in commissioning, start-up, and ongoing maintenance functions.
- Local zero and span adjustments are available for alternate adjustment method, if desired.

Description

The ST 3000 transmitter can replace any 4 to 20 milliampere output transmitter in use today, and operates over a standard two-wire system.

The measuring means is a piezoresistive sensor which actually contains three sensors in one. It contains a differential pressure sensor, a temperature sensor, and a static pressure sensor. Microprocessor-based electronics provide higher span-turndown ratio, improved temperature and pressure compensation, and improved accuracy.

Like other Smartline Transmitters, the ST 3000 features two-way communication between the operator and the transmitter through our SFC. You can connect the SFC anywhere that you can access the transmitter signal lines, and it provides the capabilities of transmitter adjustments and diagnostics from remote locations, such as the control room.

The transmitter’s meter body and electronics housing resist shock, vibration, corrosion, and moisture. The electronics housing contains a compartment for the single-board electronics, which is isolated from an integral junction box. The single-board electronics is replaceable and interchangeable with any other ST 3000 Series 900 or Series 100e model transmitter.

Specifications

Operating Conditions – All Models

Parameter	Reference Condition (at zero static)		Rated Condition		Operative Limits		Transportation and Storage	
	°C	°F	°C	°F	°C	°F	°C	°F
Ambient Temperature	25 ±1	77 ±2	-40 to 85	-40 to 185	-40 to 85	-40 to 185	-55 to 125	-67 to 257
Meter Body Temperature	25 ±1	77 ±2	-40 to 110*	-40 to 230*	-40 to 125	-40 to 257	-55 to 125	-67 to 257
Humidity %RH	10 to 55		0 to 100		0 to 100		0 to 100	
Overpressure psi **bar**	0 0		3000** 210**		3000** 210**			
Vacuum Region - Minimum Pressure **mmHg absolute** **inH$_2$O absolute**	 Atmospheric Atmospheric		 25 13		 2 (short term†) 1 (short term†			
Supply Voltage, Current, and Load Resistance	**Voltage Range:** 10.8 to 42.4 Vdc at terminals **Current Range:** 3.0 to 21.8 mA **Load Resistance:** 0 to 1440 ohms (as shown in Figure 2)							

* For CTFE fill fluid, the rating is –15 to 70°C (5 to 158°F)

** For models STD924 and STD930, static limit is 2000 psi (140 bar) for temperatures below –15°C (5°F). Overpressure is 3K.

† Short term equals 2 hours at 70°C (158°F)

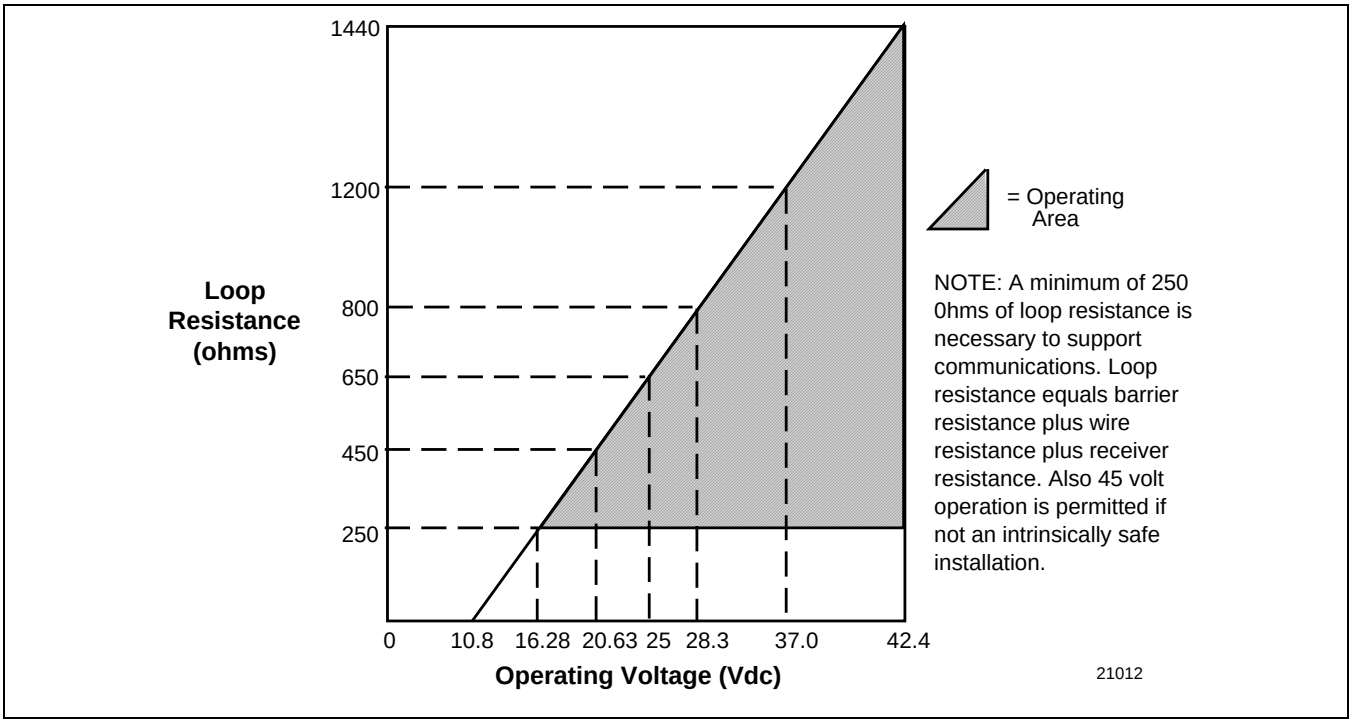

Figure 2—Supply voltage and loop resistance chart

Performance Under Rated Conditions* - Model STD924 (0 to 400 inH_2O/1000 mbar)

Parameter	Description
Upper Range Limit **inH_2O** **mbar**	400 (39.2°F/4°C is standard reference temperature for inH_2O range.) 1000
Minimum Span **inH_2O** **mbar**	10 Note: Recommended minimum span in square root mode is 20 inH_2O (50 mbar). 25
Turndown Ratio	40 to 1
Zero Elevation and Suppression	–5 to +100% URL.
Accuracy (Reference – Includes combined effects of linearity, hysteresis, and repeatability) • *Accuracy includes residual error after averaging successive readings.* • *For FOUNDATION Fieldbus use Digital Mode specifications. For HART use Analog Mode specifications.*	**In Analog Mode:** ±0.10% of calibrated span or upper range value (URV), whichever is greater, terminal based. For URV below reference point (25 inH_2O), accuracy equals: $\pm 0.05 + 0.05 \left(\frac{25 \text{ in}H_2O}{\text{span in}H_2O} \right)$ or $\pm 0.05 + 0.05 \left(\frac{62 \text{ mbar}}{\text{span mbar}} \right)$ in % span **In Digital Mode:** ±0.075% of calibrated span or upper range value (URV), whichever is greater, terminal based. For URV below reference point (25 inH_2O), accuracy equals: $\pm 0.025 + 0.05 \left(\frac{25 \text{ in}H_2O}{\text{span in}H_2O} \right)$ or $\pm 0.025 + 0.05 \left(\frac{62 \text{ mbar}}{\text{span mbar}} \right)$ in % span
Zero Temperature Effect per 28°C (50°F)	**In Analog Mode:** ±0.1625% of span. For URV below reference point (50 inH_2O), effect equals: $\pm 0.0125 + 0.15 \left(\frac{50 \text{ in}H_2O}{\text{span in}H_2O} \right)$ or $\pm 0.0125 + 0.15 \left(\frac{125 \text{ mbar}}{\text{span mbar}} \right)$ in % span **In Digital Mode:** ±0.15% of span. For URV below reference point (50 inH_2O), effect equals: $\pm 0.15 \left(\frac{50 \text{ in}H_2O}{\text{span in}H_2O} \right)$ or $\pm 0.15 \left(\frac{125 \text{ mbar}}{\text{span mbar}} \right)$ in % span
Combined Zero and Span Temperature Effect per 28°C (50°F)	**In Analog Mode:** ±0.25% of span. For URV below reference point (50 inH_2O), effect equals: $\pm 0.10 + 0.15 \left(\frac{50 \text{ in}H_2O}{\text{span in}H_2O} \right)$ or $\pm 0.10 + 0.15 \left(\frac{125 \text{ mbar}}{\text{span mbar}} \right)$ in % span **In Digital Mode:** ±0.225% of span. For URV below reference point (50 inH_2O), effect equals: $\pm 0.075 + 0.15 \left(\frac{50 \text{ in}H_2O}{\text{span in}H_2O} \right)$ or $\pm 0.075 + 0.15 \left(\frac{125 \text{ mbar}}{\text{span mbar}} \right)$ in % span
Zero Static Pressure Effect per 1000 psi (70 bar)	±0.1625% of span. For URV below reference point (50 inH_2O), effect equals: $\pm 0.0125 + 0.15 \left(\frac{50 \text{ in}H_2O}{\text{span in}H_2O} \right)$ or $\pm 0.0125 + 0.15 \left(\frac{125 \text{ mbar}}{\text{span mbar}} \right)$ in % span
Combined Zero and Span Static Pressure Effect per 1000 psi (70 bar)	±0.30% of span. For URV below reference point (50 inH_2O), effect equals: $\pm 0.15 + 0.15 \left(\frac{50 \text{ in}H_2O}{\text{span in}H_2O} \right)$ or $\pm 0.15 + 0.15 \left(\frac{125 \text{ mbar}}{\text{span mbar}} \right)$ in % span
Stability	±0.03% of URL per year

* Performance specifications are based on reference conditions of 25°C (77°F), zero (0) static pressure, 10 to 55% RH, and 316L Stainless Steel barrier diaphragm.

Performance Under Rated Conditions* - Model STD930 (0 to 100 psi/7000 mbar)

Parameter	Description
Upper Range Limit **psi** **bar**	100 7
Minimum Span **psi** **bar**	5 0.35
Turndown Ratio	20 to 1
Zero Elevation and Suppression	–5 to +100% URL.
Accuracy (Reference – Includes combined effects of linearity, hysteresis, and repeatability) • •	**In Analog Mode:** ±0.10% of calibrated span or upper range value (URV), whichever is greater, terminal based. For URV below reference point (20 psi), accuracy equals: $\pm 0.05 + 0.05 \left(\frac{20 \text{ psi}}{\text{span psi}}\right)$ or $\pm 0.05 + 0.05 \left(\frac{1.4 \text{ bar}}{\text{span bar}}\right)$ in % span **In Digital Mode:** ±0.075% of calibrated span or upper range value (URV), whichever is greater, terminal based. For URV below reference point (20 psi), accuracy equals: $\pm 0.025 + 0.05 \left(\frac{20 \text{ psi}}{\text{span psi}}\right)$ or $\pm 0.025 + 0.05 \left(\frac{1.4 \text{ bar}}{\text{span bar}}\right)$ in % span
Zero Temperature Effect per 28°C (50°F)	**In Analog Mode:** ±0.1625% of span. For URV below reference point (30 psi), effect equals: $\pm 0.0125 + 0.15 \left(\frac{30 \text{ psi}}{\text{span psi}}\right)$ or $\pm 0.0125 + 0.15 \left(\frac{2 \text{ bar}}{\text{span bar}}\right)$ in % span **In Digital Mode:** ±0.15% of span. For URV below reference point (30 psi), effect equals: $\pm 0.15 \left(\frac{30 \text{ psi}}{\text{span psi}}\right)$ or $\pm 0.15 \left(\frac{2 \text{ bar}}{\text{span bar}}\right)$ in % span
Combined Zero and Span Temperature Effect per 28°C (50°F)	**In Analog Mode:** ±0.25% of span. For URV below reference point (30 psi), effect equals: $\pm 0.10 + 0.15 \left(\frac{30 \text{ psi}}{\text{span psi}}\right)$ or $\pm 0.10 + 0.15 \left(\frac{2 \text{ bar}}{\text{span bar}}\right)$ in % span **In Digital Mode:** ±0.225% of span. For URV below reference point (30 psi), effect equals: $\pm 0.075 + 0.15 \left(\frac{30 \text{ psi}}{\text{span psi}}\right)$ or $\pm 0.075 + 0.15 \left(\frac{2 \text{ bar}}{\text{span bar}}\right)$ in % span
Zero Static Pressure Effect per 1000 psi (70 bar)	±0.1625% of span. For URV below reference point (30 psi), effect equals: $\pm 0.0125 + 0.15 \left(\frac{30 \text{ psi}}{\text{span psi}}\right)$ or $\pm 0.0125 + 0.15 \left(\frac{2 \text{ bar}}{\text{span bar}}\right)$ in % span
Combined Zero and Span Static Pressure Effect per 1000 psi (70 bar)	±0.30% of span. For URV below reference point (30 psi), effect equals: $\pm 0.15 + 0.15 \left(\frac{30 \text{ psi}}{\text{span psi}}\right)$ or $\pm 0.15 + 0.15 \left(\frac{2 \text{ bar}}{\text{span bar}}\right)$ in % span
Stability	±0.04% of URL per year

* Performance specifications are based on reference conditions of 25°C (77°F), zero (0) static pressure, 10 to 55% RH, and 316L Stainless Steel barrier diaphragm.

Performance Under Rated Conditions* - Model STD974 (0 to 3000 psi/210 bar)

Parameter	Description
Upper Range Limit **psi** **bar**	3000 210
Minimum Span **psi** **bar**	100 7
Turndown Ratio	30 to 1
Zero Elevation and Suppression	–0.6 and +100% URL.
Accuracy (Reference – Includes combined effects of linearity, hysteresis, and repeatability) • *Accuracy includes residual error after averaging successive readings.* • *For FOUNDATION Fieldbus use Digital Mode specifications. For HART use Analog Mode specifications.*	**In Analog Mode:** ±0.2% of calibrated span or upper range value (URV), whichever is greater, terminal based. For URV below reference point (300 psi), accuracy equals: $\pm 0.05 + 0.15 \left(\frac{300\ \text{psi}}{\text{span psi}}\right)$ or $\pm 0.05 + 0.15 \left(\frac{21\ \text{bar}}{\text{span bar}}\right)$ in % span **In Digital Mode:** ±0.175% of calibrated span or upper range value (URV), whichever is greater, terminal based. For URV below reference point (300 psi), accuracy equals: $\pm 0.025 + 0.15 \left(\frac{300\ \text{psi}}{\text{span psi}}\right)$ or $\pm 0.025 + 0.15 \left(\frac{21\ \text{bar}}{\text{span bar}}\right)$ in % span
Zero Temperature Effect per 28°C (50°F)	**In Analog Mode:** ±0.2125% of span. For URV below reference point (500 psi), effect equals: $\pm 0.0125 + 0.20 \left(\frac{500\ \text{psi}}{\text{span psi}}\right)$ or $\pm 0.0125 + 0.20 \left(\frac{35\ \text{bar}}{\text{span bar}}\right)$ in % span **In Digital Mode:** ±0.20% of span. For URV below reference point (500 psi), effect equals: $\pm 0.20 \left(\frac{500\ \text{psi}}{\text{span psi}}\right)$ or $\pm 0.20 \left(\frac{35\ \text{bar}}{\text{span bar}}\right)$ in % span
Combined Zero and Span Temperature Effect per 28°C (50°F)	**In Analog Mode:** ±0.325% of span. For URV below reference point (500 psi), effect equals: $\pm 0.125 + 0.20 \left(\frac{500\ \text{psi}}{\text{span psi}}\right)$ or $\pm 0.125 + 0.20 \left(\frac{35\ \text{bar}}{\text{span bar}}\right)$ in % span **In Digital Mode:** ±0.30% of span. For URV below reference point (500 psi), effect equals: $\pm 0.10 + 0.20 \left(\frac{500\ \text{psi}}{\text{span psi}}\right)$ or $\pm 0.10 + 0.20 \left(\frac{35\ \text{bar}}{\text{span bar}}\right)$ in % span
Zero Static Pressure Effect per 1000 psi (70 bar)	±0.1625% of span. For URV below reference point (500 psi), effect equals: $\pm 0.0125 + 0.15 \left(\frac{500\ \text{psi}}{\text{span psi}}\right)$ or $\pm 0.0125 + 0.15 \left(\frac{35\ \text{bar}}{\text{span bar}}\right)$ in % span
Combined Zero and Span Static Pressure Effect per 1000 psi (70 bar)	±0.30% of span. For URV below reference point (500 psi), effect equals: $\pm 0.15 + 0.15 \left(\frac{500\ \text{psi}}{\text{span psi}}\right)$ or $\pm 0.15 + 0.15 \left(\frac{35\ \text{bar}}{\text{span bar}}\right)$ in % span
Stability	±0.03% of URL per year

* Performance specifications are based on reference conditions of 25°C (77°F), zero (0) static pressure, 10 to 55% RH, and 316L Stainless Steel barrier diaphragm.

Performance Under Rated Conditions - General for all Models

Parameter	Description
Output (two-wire)	Analog 4 to 20 mA or DE digital communications mode. Options available for FOUNDATION Fieldbus and HART protocol.
Supply Voltage Effect	0.005% span per volt.
Damping Time Constant	Adjustable from 0 to 32 seconds digital damping.
CE Conformity (Europe)	89/336/EEC, Electromagnetic Compatibility (EMC) Directive.
Lightning Protection Option (Code "LP")	Leakage Current: 10 microamps max. @ 42.4 VDC, 93°C Impulse Rating: 10/20 µ sec. 5,000 Amps (50 strikes) 10,000 Amps (20 strikes) (rise/decay) 10/1000 µ sec. 250 Amps (1000 strikes) 500 Amps (400 strikes)

Physical and Approval Bodies

Parameter	Description
Barrier Diaphragms Material STD924, STD930 STD974	 316L SS, Hastelloy C-276, Monel, Tantalum 316L SS, Hastelloy C-276
Process Head Material STD924, STD930 STD974	 316 SS, Carbon Steel (zinc-plated), Monel, Hastelloy 316 SS, Carbon Steel (zinc-plated), Hastelloy
Head Gaskets	Teflon, Viton (Only with 316L SS or Monel barrier diaphragms)
Meter Body Bolting	Carbon Steel (Zinc plated, standard) or A286 SS (NACE) bolts and 302/304 SS (NACE) nuts for heads and 316 SS (NACE) bolts for adapters (standard option).
Mounting Bracket	Carbon Steel (Zinc-plated) or Stainless Steel angle bracket or Carbon Steel flat bracket available (standard options).
Fill Fluid	Silicone DC 200 oil or CTFE (Chlorotrifluoroethylene)
Electronic Housing	Epoxy-Polyester hybrid paint. Low Copper-Aluminum. Meets NEMA 4X (watertight) and NEMA 7 (explosionproof). Stainless steel optional.
Process Connections	1/4-inch NPT; 1/2-inch NPT with adapter, standard option; DIN.
Wiring	Accepts up to 16 AWG (1.5 mm diameter).
Mounting	Can be mounted in virtually any position using the standard mounting bracket. Bracket is designed to mount on 2-inch (50 mm) vertical or horizontal pipe. See Figure 3.
Dimensions	See Figures 4 and 5.
Net Weight	9 pounds (4.1 Kg)
Approval Bodies	Approved as explosionproof and intrinsically safe for use in Class I, Division 1, Groups A, B, C, D locations, and nonincendive for Class I, Division 2, Groups A, B, C, D locations. Approved EEx ia IIC T5 and EEx d IIC T6 per CENELEC standards; and Ex N II T5 per BS 6941. Series 900 with HC (HART) compatibility is self-certified for Zone 2, T5, maximum 42V/22 mA.

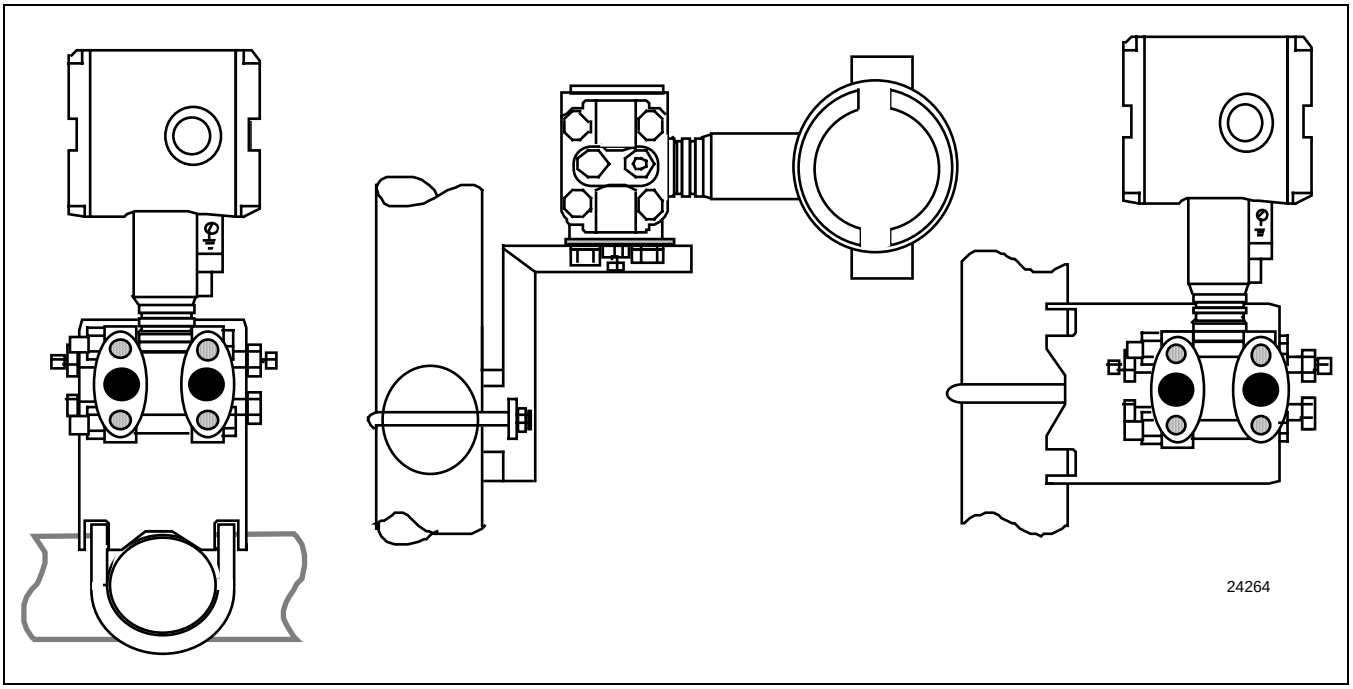

Figure 3—Examples of typical mounting positions

Reference Dimensions: millimeters / inches

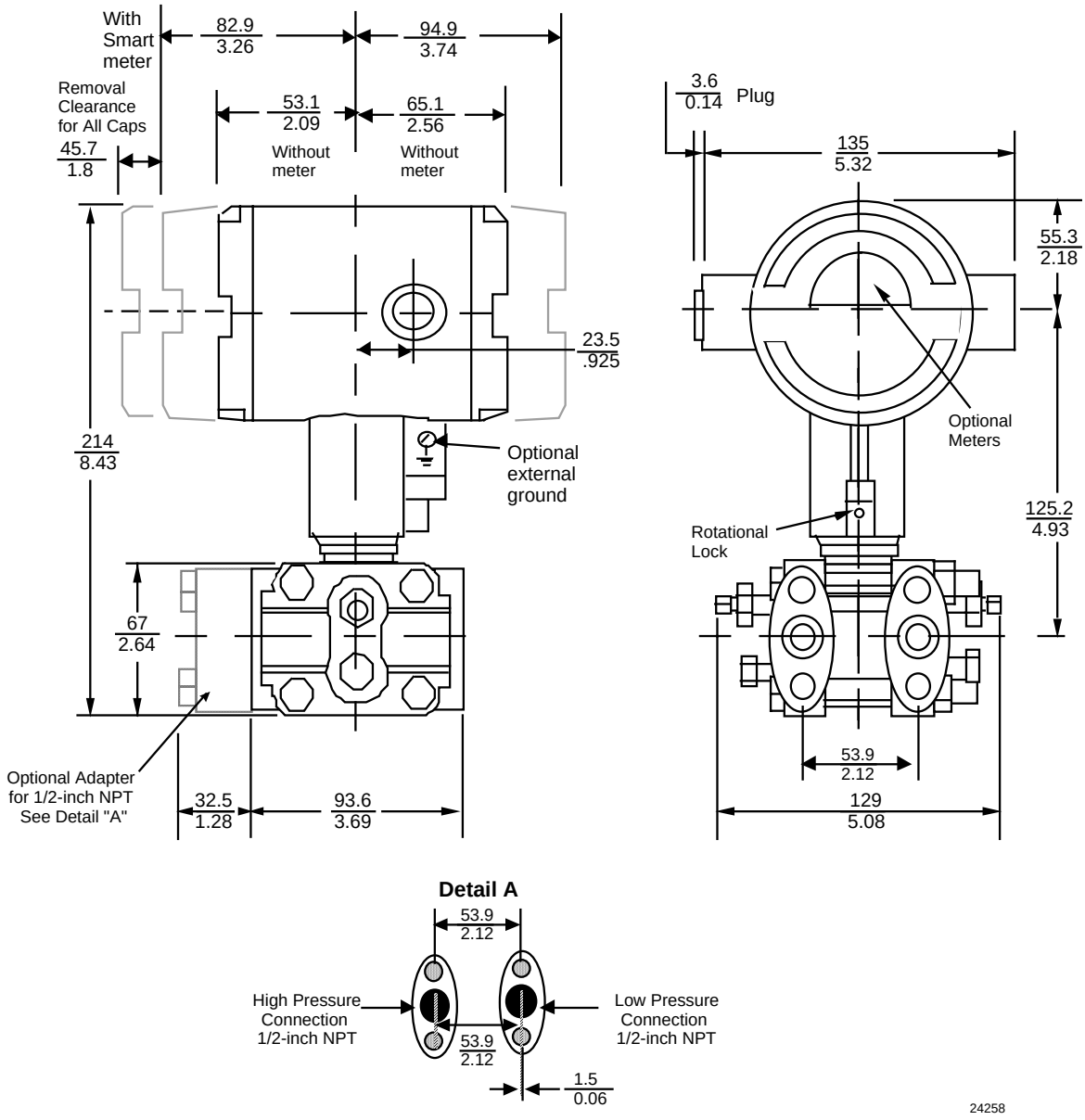

Figure 4—Typical models STD924 and STD930-A, B, E, F, J (SS, Hastelloy C) mounting dimensions for reference.

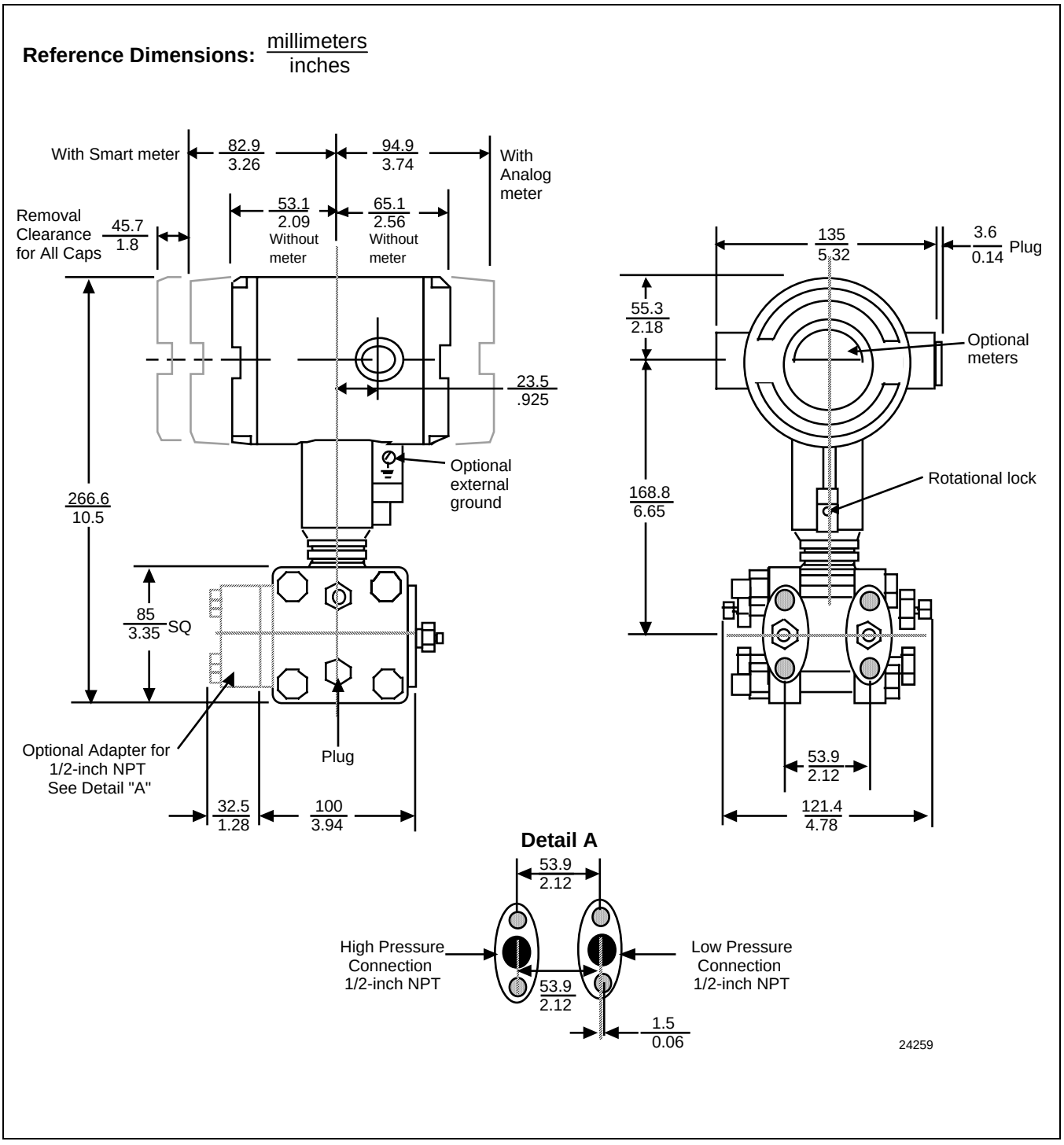

Figure 5—Typical models STD924 and STD930-C, D, G, H, K, L (Monel, Tantalum), and model STD974 mounting dimensions for reference

Options

Mounting Bracket
The angle mounting bracket is available in either zinc-plated carbon steel or stainless steel and is suitable for horizontal or vertical mounting on a two inch (50 millimeter) pipe, as well as wall mounting. An optional flat mounting bracket is also available in carbon steel for two inch (50 millimeter) pipe mounting.

Indicating Meter
Two integral meter options are available. An analog meter (option ME) is available with a 0 to 100% linear scale. The Smart Meter (option SM) provides an LCD display for both analog and digital output and can be configured to display pressure in pre-selected engineering units.

Lightning Protection
A terminal block is available with circuitry that protects the transmitter from transient surges induced by nearby lightning strikes.

HART Protocol Compatibility (Option HC)
An optional electronics module is available for the Series 900 that provides HART Protocol compatibility. Transmitters with the HART Option are compatible with the AMS System. (Contact your AMS Supplier if an upgrade is required.)

Configuration of the HART Option transmitter is accomplished using a Universal HART Communicator. For full functionality the communicator must contain the Honeywell Device Description (DD). Contact your nearest Honeywell office or distributor for further information regarding this option.

Tagging (Option TG)
Up to 30 characters can be added on the stainless steel nameplate mounted on the transmitter's electronics housing at no extra cost. Note that a separate nameplate on the meter body contains the serial number and body-related data. A stainless steel wired on tag with additional data of up to 4 lines of 28 characters is also available. The number of characters for tagging includes spaces.

Transmitter Configuration (Option TC)
The factory can configure the transmitter linear/square root extraction, damping time, LRV, URV and mode (analog/digital) and enter an ID tag of up to eight characters and scratchpad information as specified.

Custom Calibration and ID in Memory (Option CC)
The factory can calibrate any range within the scope of the transmitter's range and enter an ID tag of up to eight characters in the transmitter's memory.

FOUNDATION Fieldbus (Option FF)
Equips transmitter with FF protocol for use in 31.25 kbit/s FF networks. See document 34-ST-03-72 for additional information on ST 3000 Fieldbus transmitters.

Specifications are subject to change without notice.
(Note that specifications may differ slightly for transmitters manufactured before October 30, 1995.)

Ordering Information

Contact your nearest Honeywell sales office, or

In the U.S.:
Honeywell
Industrial Automation & Control
16404 N. Black Canyon Highway
Phoenix, AZ 85023
1-800-288-7491

In Canada:
The Honeywell Centre
155 Gordon Baker Rd.
North York, Ontario
M2H 3N7
1-800-461-0013

In Latin America:
Honeywell Inc.
480 Sawgrass Corporate Parkway,
Suite 200
Sunrise, FL 33325
(954) 845-2600

In Europe:
Honeywell PACE
1, Avenue du Bourget
B-1140 Brussels, Belgium
[32-2] 728-2111

In Asia:
Honeywell Asia Pacific Inc.
Room 3213-25
Sun Hung Kai Centre
No. 30 Harbour Road
Wanchai, Hong Kong
2829-8298

In the Pacific:
Honeywell Limited
5 Thomas Holt Drive
North Ryde NSW 2113
Australia
(61 2) 9353 7000

Or, visit Honeywell on the World Wide Web at:
http://www.honeywell.com

Model Selection Guide

34-ST-16-24

Instructions

- Select the desired Key Number. The arrow to the right marks the selection available.
- Make one selection from each table, I and II, using the column below the proper arrow. Select as many Table III options as desired (if no options are desired, specify 00). A dot denotes unrestricted availability. A letter denotes restricted availability. Restrictions follow Table IV.

Key Number		I		II		III (Optional)		IV
_ _ _ _ _ _	-	_ _ _	-	_ _ _ _ _	-	_ _, _ _ _ _	+	XXXX

KEY NUMBER

Span	Selection	Availability		
0-10" to 0-400" H2O/0-25 to 1000 mbar	STD924	↓		
Body Rating: 3000 psi (210 bar)				
0-5 to 0-100 psi/0-0.34 to 0-7 bar	STD930		↓	
Body Rating: 3000 psi (210 bar)				
0-100 to 0-3000 psi/0-7 to 0-210 bar	STD974			↓
Body Rating: 3000 psi (210 bar)				

TABLE I - METER BODY

	Wetted Process Heads	Vent/Drain Valves ** and Plugs	Barrier Diaphragms				
	Carbon Steel *	316 St. St.	316 LSS	A _ _	•	•	•
	Carbon Steel *	316 St. St.	Hastelloy C	B _ _	•	•	•
	Carbon Steel *	316 St. St.	Monel	C _ _	•	•	
Material	Carbon Steel *	316 St. St.	Tantalum	D _ _	•	•	
of	316 St. St.	316 St. St.	316 LSS	E _ _	•	•	•
Construction	316 St. St.	316 St. St.	Hastelloy C	F _ _	•	•	•
	316 St. St.	316 St. St.	Monel	G _ _	•	•	
	316 St. St.	316 St. St.	Tantalum	H _ _	•	•	
	Hastelloy C	Hastelloy C	Hastelloy C	J _ _	•	•	v
	Hastelloy C	Hastelloy C	Tantalum	K _ _	v	v	
	Monel	Monel	Monel	L _ _	v	v	
Fill Fluid	Silicone			_ 1 _	•	•	•
	CTFE			_ 2 _	•	•	•
Process Head	1/4" NPT			_ _ A	•	•	•
Configuration	1/2" NPT with Adapter (on 1/4" NPT Head)			_ _ H	t	t	t

TABLE II

No Selection	00000	•	•	•

* Carbon Steel heads are zinc-plated. Not recommended for water service due to hydrogen migration. Use Stainless Steel heads.

** Vent/Drains are Teflon coated for lubricity.

Model Selection Guide, continued

TABLE III - OPTIONS	Selection	Availability STD9 24	30	74	
None	00	•	•	•	
Adapter Flange - 1/2" NPT St. Steel	S2	c	c	c	
Adapter Flange - 1/2" NPT Hastelloy-C	T2	c	c	c	b
Adapter Flange - 1/2" NPT Monel	V2	c	c	c	
Modified DIN Process Heads - 316SS	DN	w	w	w	
Viton Head Gaskets (1/2" adapter gaskets are special)	VT	z	z	z	
Mounting Bracket - Carbon Steel	MB	•	•	•	
Mounting Bracket - ST. ST.	SB	•	•	•	b
Flat Mounting Bracket - Carbon Steel	FB	•	•	•	
316 ST.ST. Electronics Housing with M20 Conduit Connections	SH	m	m	m	
1/2" NPT to M20 316SS Conduit Adapter (BASEEFA EEx d IIC)	A1	n	n	n	b
1/2" NPT to 3/4" NPT 316 SS Conduit Adapter	A2	u	u	u	
Lightning Protection	LP	•	•	•	
Analog Meter (0-100 Even 0-10 Square Root)	ME	•	•	•	b
Smart Meter	SM	•	•	•	
Local Zero	LZ	x	x	x	
Local Zero and Span	ZS	s	s	s	
A286SS (NACE) Bolts and 302/304SS (NACE) Nuts for Heads and 316SS (NACE) Bolts for Adapters	CR	•	•	•	
Stainless Steel Customer Wired-On Tag (4 lines, 28 characters per line, customer supplied information)	TG	•	•	•	
Stainless Steel Customer Wired-On Tag (blank)	TB	•	•	•	
Custom Calibration and I.D. in Memory	CC	•	•	•	
Transmitter Configuration	TC	•	•	•	
Write Protection	WP	•	•	•	
Additional Warranty - 1 year	W1	•	•	•	
Additional Warranty - 2 years	W2	•	•	•	b
Additional Warranty - 3 years	W3	•	•	•	
Additional Warranty - 4 years	W4	•	•	•	
Clean Transmitter for Oxygen or Chlorine Service with Certificate	0X	j	j	j	
Over-Pressure Leak Test with F3392 Certificate	TP	•	•	•	
Side Vent/Drain (End Vent Drain is standard)	SV	g	g	y	
SS Center Vent Drain and Bushing	CV	g	g		b
Blind DIN SS Flanges Mounted with NACE Bolts	B2	d	d	d	
Low Temperature - -50°C Ambient Limit	LT	•			
Calibration Test Report and Certificate of Conformance (F3399)	F1	•	•	•	b
Certificate of Conformance (F3391)	F3	•	•	•	
Certificate of Origin (F0195)	F5	•	•	•	
NACE Certificate (F0198)	F7	o	o	o	
HART® Protocol Compatible Electronics	HC	e	e	e	b
FOUNDATION Fieldbus Communications	FF	r	r	r	

Model Selection Guide, continued

TABLE III - OPTIONS (continued)

Approval Body	Approval Type	Location or Classification	STD9 Selection	Availability 24	30	74	
No hazardous location approvals			9X	•	•	•	
Factory Mutual	Explosion Proof	Class I, Div. 1, Groups A,B,C,D	1C	•	•	•	
	Dust Ignition Proof	Class II, III Div. 1, Groups E,F,G					
	Non-Incendive	Class I, Div. 2, Groups A,B,C,D					
	Intrinsically Safe	Class I, II, III, Div. 1, Groups A,B,C,D,E,F,G					b
CSA	Explosion Proof	Class I, Div. 1, Groups B,C,D	2J	•	•	•	
	Dust Ignition Proof	Class II, III, Div. 1, Groups E,F,G					
	Intrinsically Safe	Class I, II, III, Div. 1, Groups A,B,C,D,E,F,G					
Zone 2 (Europe)	Self-Declared per 94/9/EC (ATEX4)	Ex II 3 GD T (1) X (1) T4 at Tamb. 93°C, T5 at Tamb. 80°C, T6 at Tamb. 65°C	3N	•	•	•	
SA (Australia)	Intrinsically Safe	Ex ia IIC T4	4H	a	a	a	
	Non-Incendive	Ex n IIC T6 (T4 with SM option)					
	Flame Proof	Ex d IIC T6					
LCIE CENELEC	Flame Proof	EEx d IIC T6	3A	f	f	f	
	Intrinsically Safe	EEx ia IIC T5					
	Flame Proof	EEx d IIC T6	3D	•	h	•	
	Intrinsically Safe	EEx ia IIC T5	3S		k		

TABLE IV

Factory Identification	XXXX	•	•	•

Model Selection Guide, continued

RESTRICTIONS

Restriction Letter	Table	Available Only With Selection	Table	Not Available With Selection
a	Approval Body pending			
b	Select only one option from this group			
c	I	_ _ H		
d	I III	E _ A, F _ A, G _ A, H _ A DN		
e	Ill	1C, 2J, 3D, 3N, 9X		
f	III	HC	I	STD930-C _ _, G _ _, L _ _
g			I	K _ _, L _ _ includes side vent no price add
h			I	C _ _, G _ _, L _ _
j	I	_ 2 _		
k	I	C _ _, G _ _, L _ _		
m			III	ZS, 1C, 2J
n			III	1C, 2J
o	III	CR or B2		
r			III	TC, ME
s			III	FF, ME
t	III	Select from Table III S2, T2, V2		
u	III	1C, 2J		
v		Includes side vent drain - no price add		
w	I	E _ A, F _ A, G _ A, H _ A	III	SV
x	III	FF, SM		
y			I III	J_ _, includes side vent, no price add DN
z			I	B _ _, D _ _, F _ _, H _ _, J _ _, K _ _

Note: See 13:ST-27 for Published Specials with pricing.
See 13:ST-29 and User's Manual for part numbers.
See 13:ST-OE-9 for OMS Order Entry Information including TC, manuals, certificates, drawings and SPINS.
See 13:ST-OD-1 for tagging, ID, Transmitter Configuration (TC) and calibration including factory default values.
To request a quotation for a non-published "special", fax RFQ to Marketing Applications.

Honeywell

Industrial Automation and Control
Honeywell Inc.
16404 North Black Canyon Highway
Phoenix, Arizona 85023-3099

Honeywell

ST 3000 Smart Transmitter
Series 100 Gauge Pressure Models

STG140	0 to 500 psi	0 to 35 bar	/	STG17L	0 to 3000 psi	0 to 210 bar
STG14L	0 to 500 psi	0 to 35 bar	/	STG180	0 to 6000 psi	0 to 415 bar
STG170	0 to 3000 psi	0 to 210 bar	/	STG18L	0 to 6000 psi	0 to 415 bar

34-ST-03-62
4/00

Specification and Model Selection Guide

Function

Honeywell's ST 3000® Series 100 Gauge Pressure Transmitters bring proven "smart" technology to a wide spectrum of gauge pressure measurement applications with varying process interface requirements. They transmit an output signal proportional to the measured variable in either an analog 4 to 20 milliampere format or in a digital DE protocol format for direct digital integration with our TDC 3000®X control system. Additional protocol options available for the ST 3000 Series 100 transmitters include FOUNDATION™ Fieldbus[1] and HART® [2]. See the Model Selection Guide for help in selecting the correct ordering code for the desired protocol.

You easily select the analog or digital transmission format through the Smart Field Communicator (SFC®) which is the common hand-held operator interface for our Smartline® Transmitters. All configuration, operation, and communications functions are under the control of the ST 3000 Smart Transmitter's micro-processor and are accessible through the SFC.

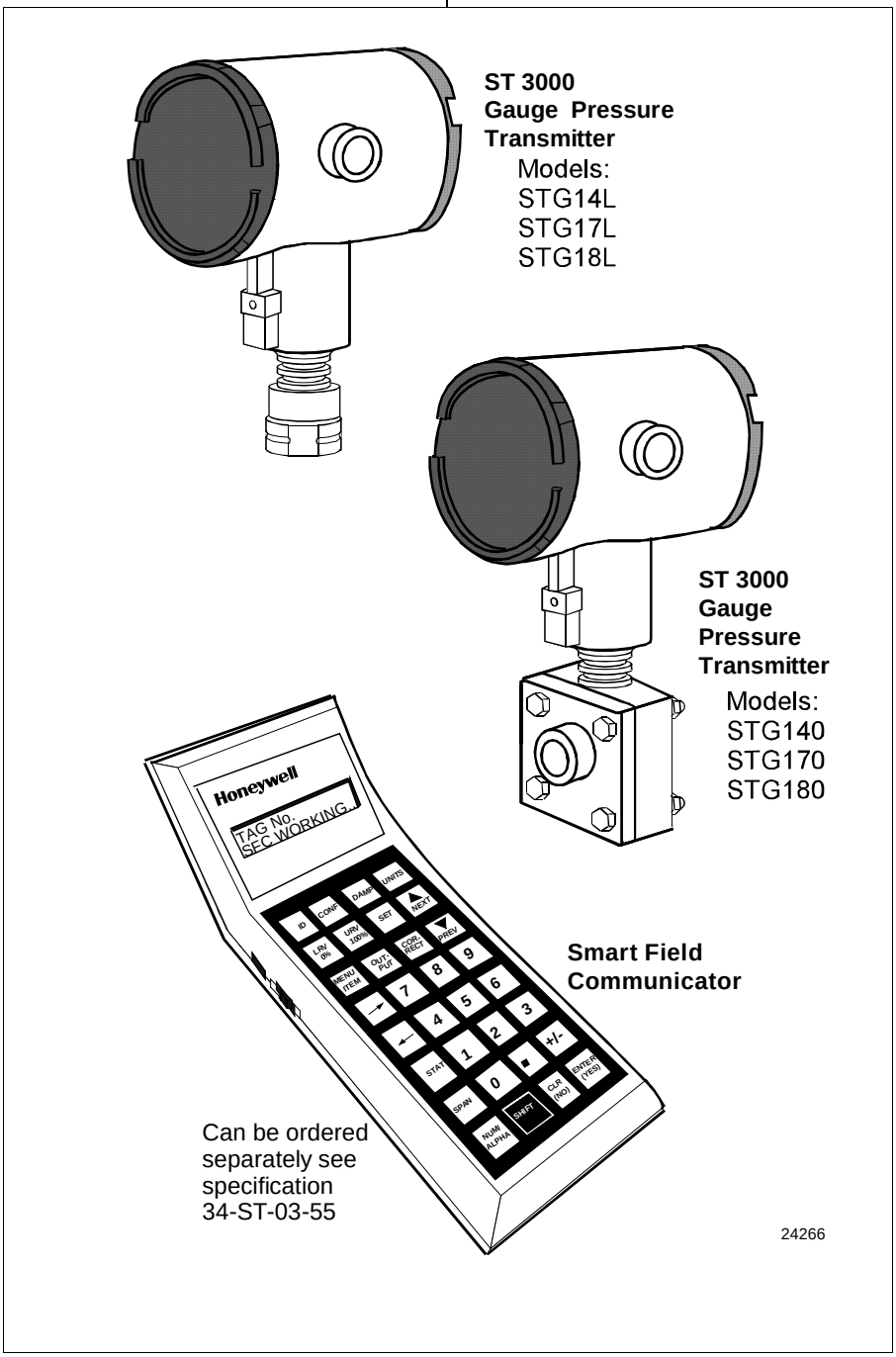

Figure 1—Series 100 Gauge Pressure Transmitters feature proven "smart" technology and come in single-head and in-line models to meet varying application needs.

[1] FOUNDATION™ Fieldbus is a trademark of the Fieldbus Foundation.

[2] HART is a registered trademark of the Hart Communication Foundation.

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Honeywell

ST 3000 Smart Transmitter
Series 900 Gauge Pressure Models

STG944	0 to 500 psi	0 to 35 bar
STG94L	0 to 500 psi	0 to 35 bar
STG974	0 to 3000 psi	0 to 210 bar
STG97L	0 to 3000 psi	0 to 210 bar
STG98L	0 to 6000 psi	0 to 415 bar

34-ST-03-67
4/00

Specification and Model Selection Guide

Function

Honeywell's ST 3000® Series 900 Gauge Pressure Transmitters bring proven "smart" technology to a wide spectrum of gauge pressure measurement applications with varying process interface requirements. They transmit an output signal proportional to the measured variable in either an analog 4 to 20 milliampere format or in a digital DE protocol format for direct digital integration with our TDC 3000®X control system. Additional protocol options available for the ST 3000 Series 900 transmitters include FOUNDATION™ Fieldbus[1] and HART® [2]. See the Model Selection Guide for help in selecting the correct ordering code for the desired protocol.

In the standard transmitter you easily select the analog or digital transmission format through the Smart Field Communicator (SFC®) which is the common hand-held operator interface for our DE-based Smartline® Transmitters. All configuration, operation, and communications functions are under the control of the ST 3000 Smart Transmitter's microprocessor and are accessible through the SFC.

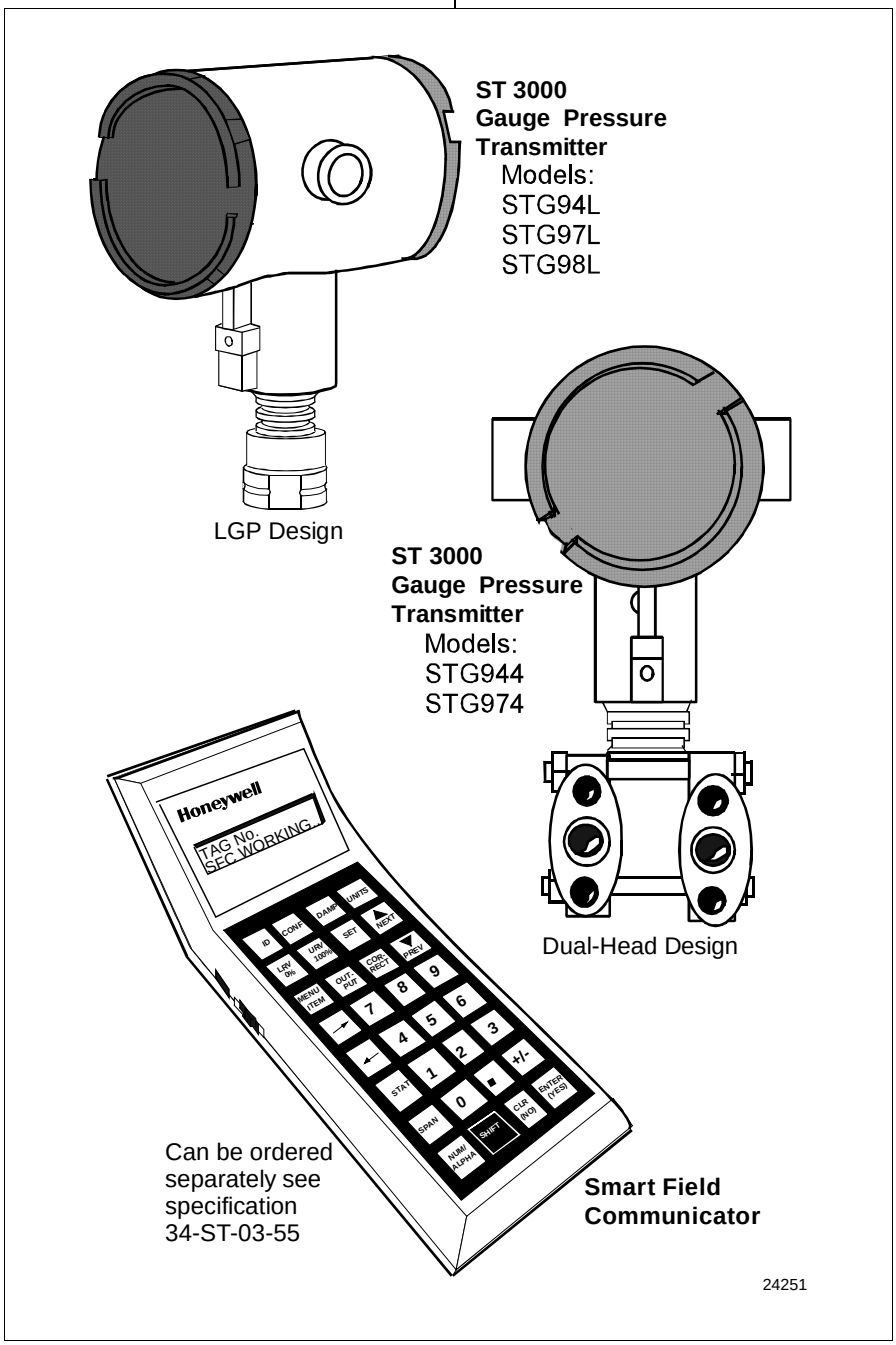

Figure 1—Series 900 Gauge Pressure Transmitters feature proven "smart" technology and come in dual-head and in-line models to meet varying application needs.

[1] FOUNDATION™ Fieldbus is a trademark of the Fieldbus Foundation.

[2] HART is a registered trademark of the Hart Communication Foundation.

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Features

- Choice of dual-head or in-line model to match process interface requirements.
- Direct digital integration with TDC 3000^X system provides local measurement accuracy to the system level without adding typical A/D and D/A converter inaccuracies.
- Unique piezoresistive sensor automatically compensates input for temperature.
- Added “smart” features include configuring lower and upper range values, simulating accurate analog output, and selecting preprogrammed engineering units for display.
- Smart transmitter capabilities with local or remote interfacing means significant manpower efficiency improvements in commissioning, start-up, and ongoing maintenance functions

Description

The ST 3000 transmitter can replace any 4 to 20 milliampere output transmitter in use today, and operates over a standard two-wire system.

The measuring means is a piezoresistive sensor which actually contains a pressure sensor and a temperature sensor.

Microprocessor-based electronics provide higher span-turndown ratio, improved temperature compensation, and improved accuracy.

Like other Smartline Transmitters, the ST 3000 features two-way communication between the operator and the transmitter through our SFC. You can connect the SFC anywhere that you can access the transmitter signal lines, and it provides the capabilities of transmitter adjustments and diagnostics from remote locations, such as the control room.

The transmitter’s meter body and electronics housing resist shock, vibration, corrosion, and moisture. The electronics housing contains a compartment for the single-board electronics, which is isolated from an integral junction box. The single-board electronics is replaceable and interchangeable with any other ST 3000 Series 900 or Series 100e model transmitter.

Specifications

Operating Conditions – All Models

Parameter	Reference Condition (at zero static)		Rated Condition		Operative Limits		Transportation and Storage	
	°C	°F	°C	°F	°C	°F	°C	°F
Ambient Temperature	25 ±1	77 ±2	-40 to 70	-40 to 158	-40 to 85	-40 to 185	-55 to 125	-67 to 257
Meter Body Temperature	25 ±1	77 ±2	-40 to 110*	-40 to 230*	-40 to 125***	-40 to 257***	-55 to 125	-67 to 257
Humidity %RH	10 to 55		0 to 100		0 to 100		0 to 100	
Overpressure STG944, 94L **psi** **bar** STG974, 97L **psi** **bar** STG98L **psi** **bar**	 0 0 0 0 0 0		 750 50 4500 310 9000 620		 750 50 4500 310 9000 620			
Vacuum Region - Minimum Pressure **mmHg absolute** **inH_2O absolute**	 atmospheric atmospheric		 25 13		 2 (short term**) 1 (short term**)			
Supply Voltage, Current, and Load Resistance	**Voltage Range:** 10.8 to 42.4 Vdc at terminals **Current Range:** 3.0 to 21.8 mA **Load Resistance:** 0 to 1440 ohms (as shown in Figure 2)							

* For model 944 with CTFE fill fluid, the rating is –15 to 70°C (5 to 158°F); for model 98L with CTFE fill fluid, the rating is –15 to 110°C (5 to 230°F).

**Short term equals 2 hours at 70°C (158 °F)

***For Models STG94L, STG97L, and STG98L, the upper limit is 110°C (230°F).

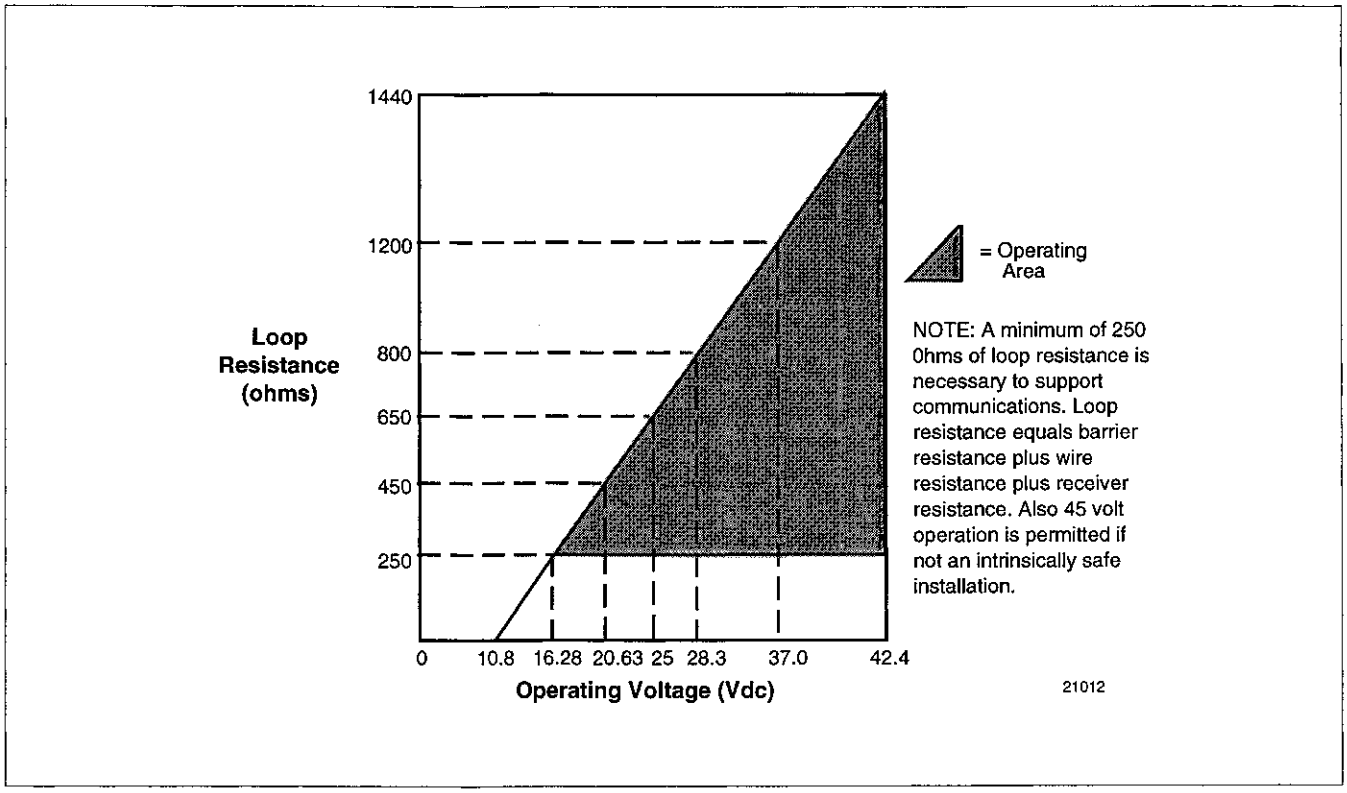


Figure 2—Supply voltage and loop resistance chart.

Performance Under Rated Conditions* - Models STG944 & 94L (0 to 500 psi/35 bar)

Parameter	Description
Upper Range Limit **psi** **bar**	500 35
Minimum Span **psi** **bar**	20 1.4
Turndown Ratio	25 to 1
Zero Elevation and Suppression	No limit except minimum span from absolute 0 (zero) to +100% URL. Specifications valid over this range.
Accuracy (Reference – Includes combined effects of linearity, hysteresis, and repeatability) • *Accuracy includes residual error after averaging successive readings.* • *For FOUNDATION Fieldbus use Digital Mode specifications. For HART use Analog Mode specifications.*	**In Analog Mode:** ±0.10% of calibrated span or upper range value (URV), whichever is greater, terminal based. For URV below reference point (20 psi), accuracy equals: $\pm 0.05 + 0.05 \left(\frac{20 \text{ psi}}{\text{span psi}}\right)$ or $\pm 0.05 + 0.05 \left(\frac{1.4 \text{ bar}}{\text{span bar}}\right)$ in % span **In Digital Mode:** ±0.075% of calibrated span or upper range value (URV), whichever is greater, terminal based. For URV below reference point (20 psi), accuracy equals: $\pm 0.025 + 0.05 \left(\frac{20 \text{ psi}}{\text{span psi}}\right)$ or $\pm 0.025 + 0.05 \left(\frac{1.4 \text{ bar}}{\text{span bar}}\right)$ in % span
Zero Temperature Effect per 28°C (50°F)	**In Analog Mode:** ±0.1625% of span. For URV below reference point (50 psi), effect equals: $\pm 0.0125 + 0.15 \left(\frac{50 \text{ psi}}{\text{span psi}}\right)$ or $\pm 0.0125 + 0.15 \left(\frac{3.5 \text{ bar}}{\text{span bar}}\right)$ in % span **In Digital Mode:** ±0.15% of span. For URV below reference point (50 psi), effect equals: $\pm 0.15 \left(\frac{50 \text{ psi}}{\text{span psi}}\right)$ or $\pm 0.15 \left(\frac{3.5 \text{ bar}}{\text{span bar}}\right)$ in % span
Combined Zero and Span Temperature Effect per 28°C (50°F)	**In Analog Mode:** ±0.25% of span. For URV below reference point (50 psi), effect equals: $\pm 0.10 + 0.15 \left(\frac{50 \text{ psi}}{\text{span psi}}\right)$ or $\pm 0.10 + 0.15 \left(\frac{3.5 \text{ bar}}{\text{span bar}}\right)$ in % span **In Digital Mode:** ±0.225% of span. For URV below reference point (50 psi), effect equals: $\pm 0.075 + 0.15 \left(\frac{50 \text{ psi}}{\text{span psi}}\right)$ or $\pm 0.075 + 0.15 \left(\frac{3.5 \text{ bar}}{\text{span bar}}\right)$ in % span
Stability	±0.03% of URL per year

* Performance specifications are based on reference conditions of 25°C (77°F), 10 to 55% RH, and 316L Stainless Steel barrier diaphragm.

Performance Under Rated Conditions* - Models STG974 & 97L (0 to 3000 psi/210 bar)

Parameter	Description
Upper Range Limit **psi** **bar**	3000 210
Minimum Span **psi** **bar**	300 21
Turndown Ratio	10 to 1
Zero Elevation and Suppression	No limit except minimum span from absolute 0 (zero) to +100% URL. Specifications valid over this range.
Accuracy (Reference – Includes combined effects of linearity, hysteresis, and repeatability) • *Accuracy includes residual error after averaging successive readings.* • *For FOUNDATION Fieldbus use Digital Mode specifications. For HART use Analog Mode specifications.*	**In Analog Mode:** ±0.10% of calibrated span or upper range value (URV), whichever is greater, terminal based. For URV below reference point (750 psi), accuracy equals: $\pm 0.05 + 0.05 \left(\frac{750 \text{ psi}}{\text{span psi}} \right)$ or $\pm 0.05 + 0.05 \left(\frac{52 \text{ bar}}{\text{span bar}} \right)$ in % span **In Digital Mode:** ±0.075% of calibrated span or upper range value (URV), whichever is greater, terminal based. For URV below reference point (300 psi), accuracy equals: $\pm 0.025 + 0.05 \left(\frac{750 \text{ psi}}{\text{span psi}} \right)$ or $\pm 0.025 + 0.05 \left(\frac{52 \text{ bar}}{\text{span bar}} \right)$ in % span
Zero Temperature Effect per 28°C (50°F)	**In Analog Mode:** ±0.2125% of span. For URV below reference point (500 psi), effect equals: $\pm 0.0125 + 0.20 \left(\frac{500 \text{ psi}}{\text{span psi}} \right)$ or $\pm 0.0125 + 0.20 \left(\frac{35 \text{ bar}}{\text{span bar}} \right)$ in % span **In Digital Mode:** ±0.20% of span. For URV below reference point (500 psi), effect equals: $\pm 0.20 \left(\frac{500 \text{ psi}}{\text{span psi}} \right)$ or $\pm 0.20 \left(\frac{35 \text{ bar}}{\text{span bar}} \right)$ in % span
Combined Zero and Span Temperature Effect per 28°C (50°F)	**In Analog Mode:** ±0.325% of span. For URV below reference point (500 psi), effect equals: $\pm 0.125 + 0.20 \left(\frac{500 \text{ psi}}{\text{span psi}} \right)$ or $\pm 0.125 + 0.20 \left(\frac{35 \text{ bar}}{\text{span bar}} \right)$ in % span **In Digital Mode:** ±0.30% of span. For URV below reference point (500 psi), effect equals: $\pm 0.10 + 0.20 \left(\frac{500 \text{ psi}}{\text{span psi}} \right)$ or $\pm 0.10 + 0.20 \left(\frac{35 \text{ bar}}{\text{span bar}} \right)$ in % span
Stability	±0.03% of URL per year

* Performance specifications are based on reference conditions of 25°C (77°F), 10 to 55% RH, and 316L Stainless Steel barrier diaphragm.

Performance Under Rated Conditions* - Model STG98L (0 to 6000 psi/415 bar)

Parameter	Description
Upper Range Limit **psi** **bar**	6000 415
Minimum Span **psi** **bar**	500 35
Turndown Ratio	12 to 1
Zero Elevation and Suppression	No limit except minimum span from absolute 0 (zero) to +100% URL. Specifications valid over this range.
Accuracy (Reference – Includes combined effects of linearity, hysteresis, and repeatability) • *Accuracy includes residual error after averaging successive readings.* • *For FOUNDATION Fieldbus use Digital Mode specifications. For HART use Analog Mode specifications.*	**In Analog Mode:** ±0.10% of calibrated span or upper range value (URV), whichever is greater, terminal based. For URV below reference point (1000 psi), accuracy equals: $\pm 0.05 + 0.05 \left(\frac{1500\ psi}{span\ psi}\right)$ or $\pm 0.05 + 0.05 \left(\frac{104\ bar}{span\ bar}\right)$ in % span **In Digital Mode:** ±0.175% of calibrated span or upper range value (URV), whichever is greater, terminal based. For URV below reference point (1000 psi), accuracy equals: $\pm 0.025 + 0.05 \left(\frac{1500\ psi}{span\ psi}\right)$ or $\pm 0.025 + 0.05 \left(\frac{104\ bar}{span\ bar}\right)$ in % span
Zero Temperature Effect per 28°C (50°F)	**In Analog Mode:** ±0.2125% of span. For URV below reference point (1000 psi), effect equals: $\pm 0.0125 + 0.20 \left(\frac{1000\ psi}{span\ psi}\right)$ or $\pm 0.0125 + 0.20 \left(\frac{70\ bar}{span\ bar}\right)$ in % span **In Digital Mode:** ±0.20% of span. For URV below reference point (1000 psi), effect equals: $\pm 0.20 \left(\frac{1000\ psi}{span\ psi}\right)$ or $\pm 0.20 \left(\frac{70\ bar}{span\ bar}\right)$ in % span
Combined Zero and Span Temperature Effect per 28°C (50°F)	**In Analog Mode:** ±0.325% of span. For URV below reference point (1000 psi), effect equals: $\pm 0.125 + 0.20 \left(\frac{1000\ psi}{span\ psi}\right)$ or $\pm 0.125 + 0.20 \left(\frac{70\ bar}{span\ bar}\right)$ in % span **In Digital Mode:** ±0.30% of span. For URV below reference point (1000 psi), effect equals: $\pm 0.10 + 0.20 \left(\frac{1000\ psi}{span\ psi}\right)$ or $\pm 0.10 + 0.20 \left(\frac{70\ bar}{span\ bar}\right)$ in % span
Stability	±0.03% of URL per year

* Performance specifications are based on reference conditions of 25°C (77°F), 10 to 55% RH, and 316L Stainless Steel barrier diaphragm.

Performance Under Rated Conditions - General for all Models

Parameter	Description
Output (two-wire)	Analog 4 to 20 mA or DE digital communications mode. Options available for FOUNDATION Fieldbus and HART protocol.
Supply Voltage Effect	0.005% span per volt.
Damping Time Constant	Adjustable from 0 to 32 seconds digital damping.
CE Conformity (Europe)	89/336/EEC, Electromagnetic Compatibility (EMC) Directive.
Lightning Protection Option **(Code "LP")**	Leakage Current: 10 microamps max. @ 42.4 VDC, 93°C Impulse Rating: 10/20 µ sec. 5,000 Amps (50 strikes) 10,000 Amps (20 strikes) (rise/decay) 10/1000 µ sec. 250 Amps (1000 strikes) 500 Amps (400 strikes)

Physical and Approval Bodies

Parameter	Description
Barrier Diaphragms Material	**Dual-Head Meter Body:** 316L SS, Hastelloy C-276 **In-Line Meter Body:** 316L SS, Hastelloy C-276
Process Head Material	**Dual-Head Meter Body:** 316 SS, Carbon Steel (zinc-plated), Hastelloy. [Reference head is Carbon Steel (zinc-plated).] **In-Line Meter Body:** 316 SS process interface.
Head Gaskets	Teflon is standard. Viton is available.
Meter Body Bolting	Carbon Steel (Zinc plated, standard) or A286 SS (NACE) bolts and 302/304 SS (NACE) nuts for heads and 316 SS (NACE) bolts for adapters (standard option).
Mounting Bracket	Carbon Steel (Zinc-plated) or Stainless Steel angle bracket or Carbon Steel flat bracket available.
Fill Fluid	Silicone oil or CTFE (Chlorotrifluoroethylene)
Electronic Housing	Epoxy-Polyester hybrid paint. Low Copper-Aluminum. Meets NEMA 4X (watertight) and NEMA 7 (explosion proof). Stainless steel optional.
Process Connections	**Dual-Head Meter Body:** 1/4-inch NPT; 1/2-inch NPT with adapter or DIN, standard option. **In-Line Meter Body:** 1/2-inch NPT
Wiring	Accepts up to 16 AWG (1.5 mm diameter).
Mounting	Can be mounted in virtually any position using the standard mounting bracket. Bracket is designed to mount on 2-inch (50 mm) vertical or horizontal pipe. See Figure 3 for dual-head models, and Figure 4 for in-line models.
Dimensions	See Figures 5 and 6.
Net Weight	**With Dual-Head Meter Body:** 9 pounds (4.1 Kg) **With In-Line Meter Body:** 3.8 pounds (1.7 Kg)
Approval Bodies	Approved as explosion proof and intrinsically safe for use in Class I, Division 1, Groups A, B, C, D locations, and nonincendive for Class I, Division 2 Groups A, B, C, D locations. Approved EEx ia IIC T5 and EEx d IIC T6 per CENELEC standards; and Ex N II T5 per BS 6941. Series 900 with HC (HART) Compatibility is self certified for Zone 2, T5, maximum 42V/22 mA.

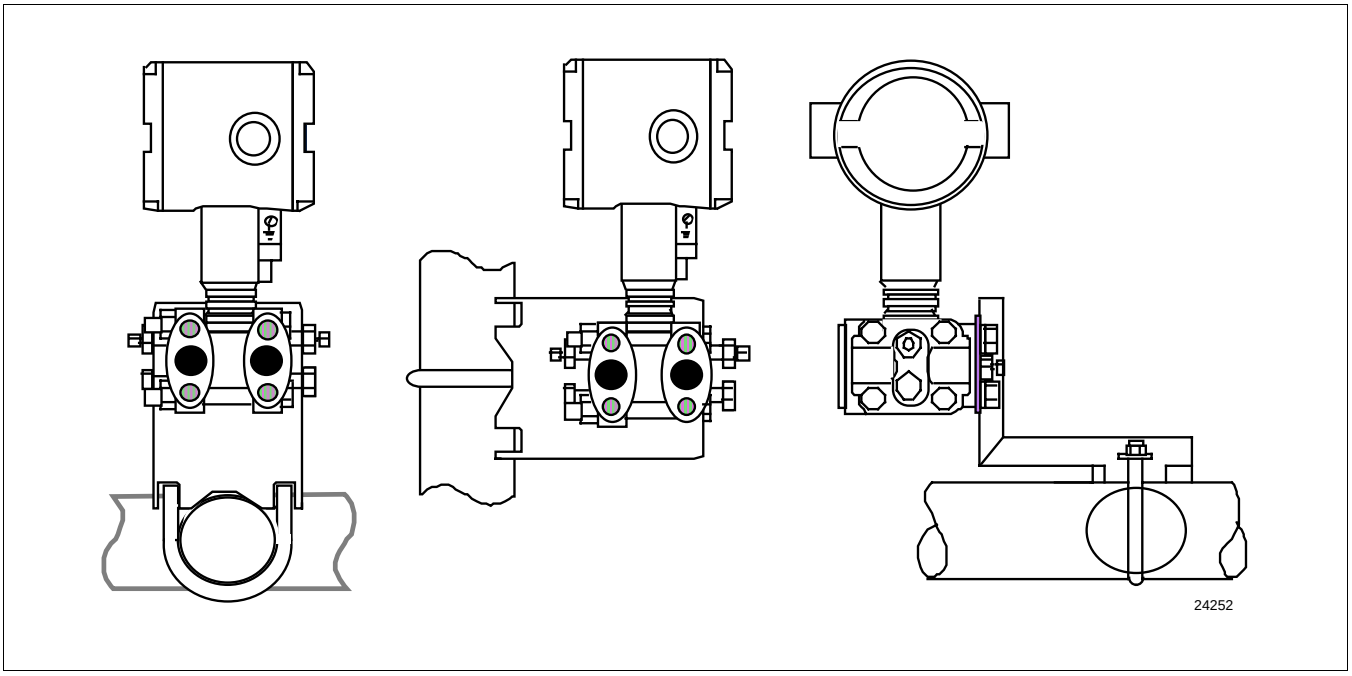


Figure 3—Examples of typical mounting positions for dual-head models STG944 and STG974

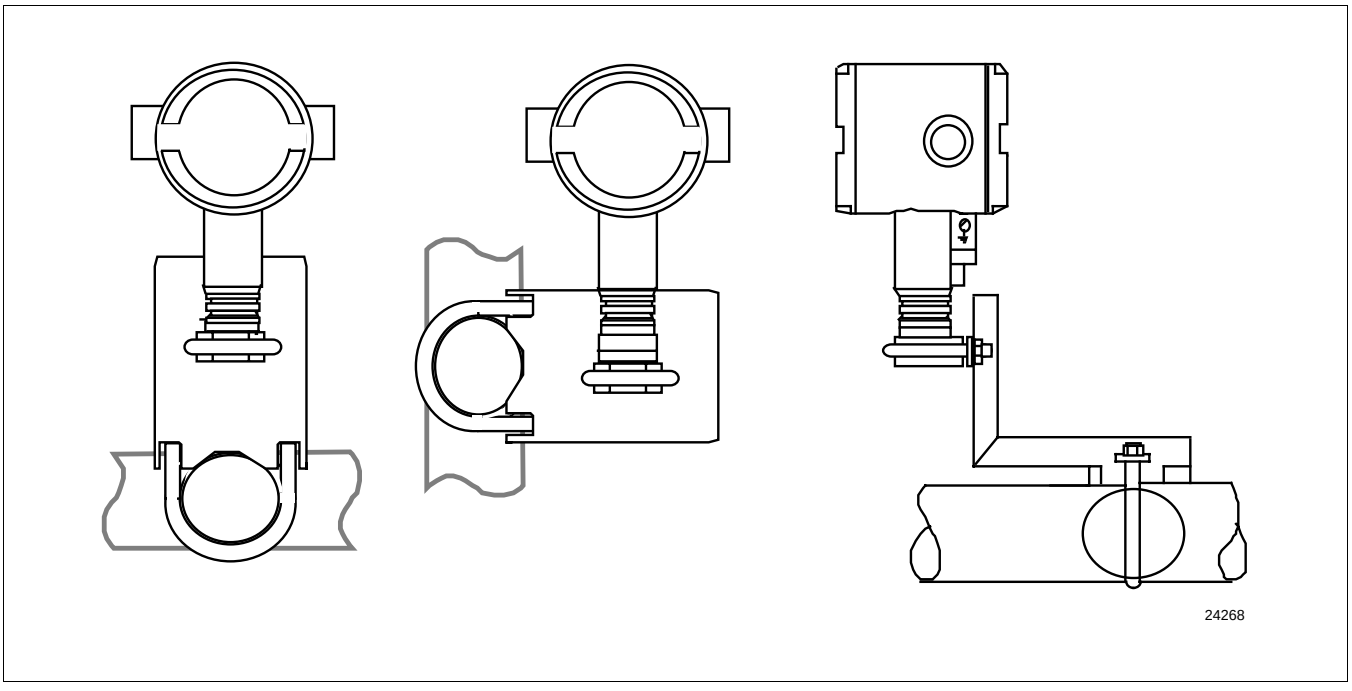


Figure 4—Examples of typical mounting positions for in-line models STG94L, STG97L, and STG98L. Note that a mounting bracket is not required for in-line models.

Reference Dimensions: millimeters / inches

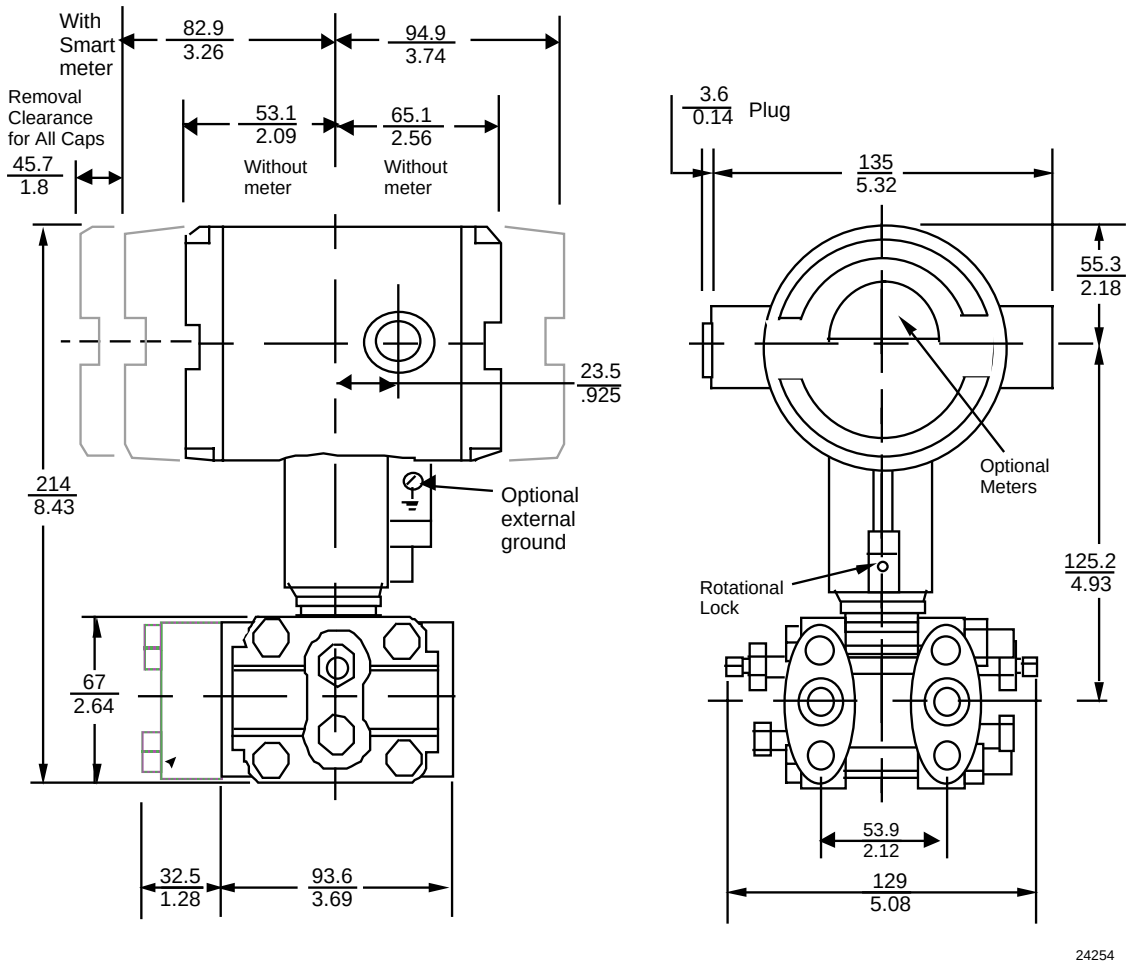


Figure 5—Typical mounting dimensions for dual-head models STG944 and STG974 for reference

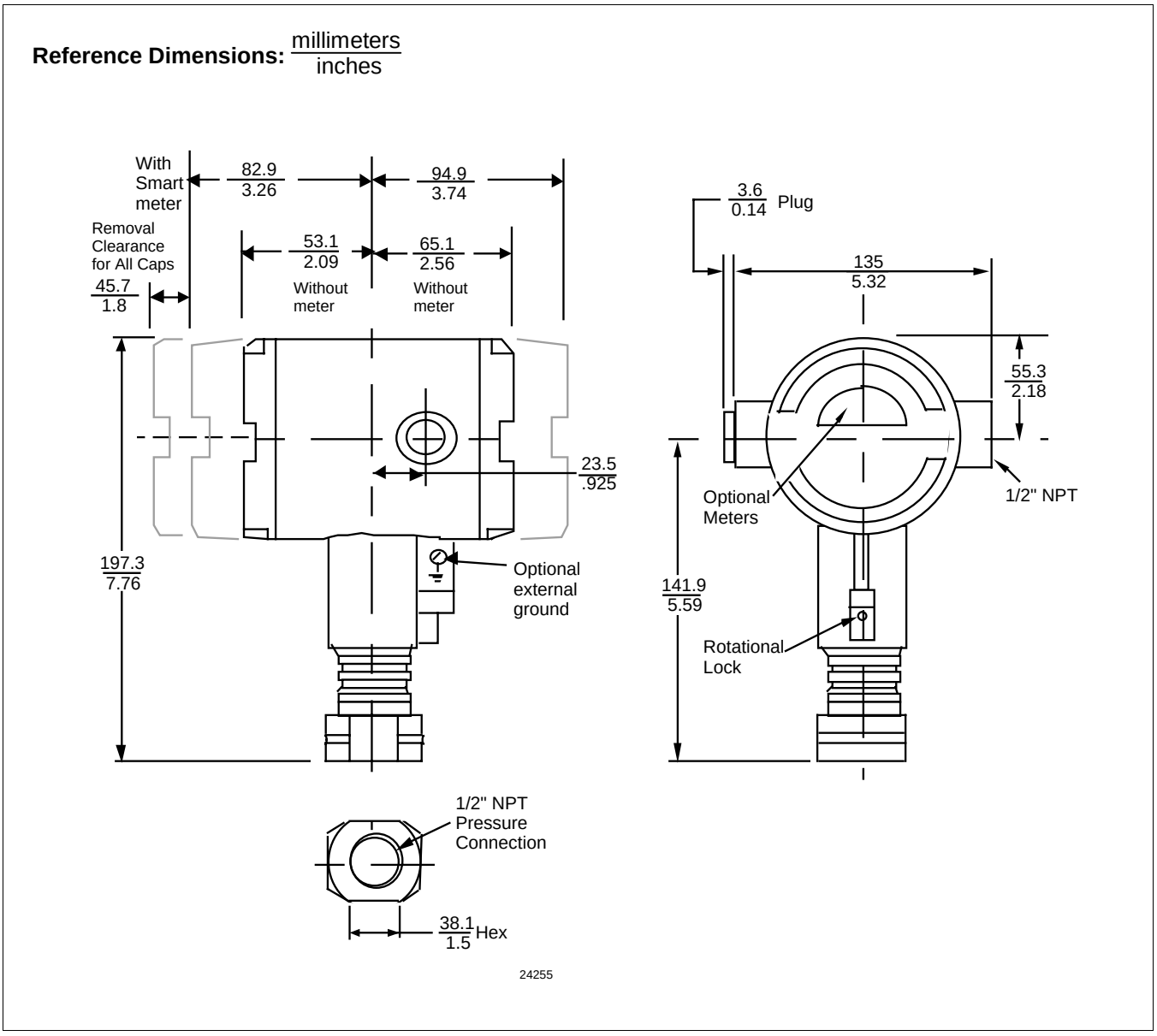


Figure 6—Typical mounting dimensions for in-line models STG94L, STG97L, and STG98L for reference

Options

Mounting Bracket
The angle mounting bracket is available in either zinc-plated carbon steel or stainless steel and is suitable for horizontal or vertical mounting on a two inch (50 millimeter) pipe, as well as wall mounting. An optional flat mounting bracket is also available in carbon steel for two inch (50 millimeter) pipe mounting.

Indicating Meter
Two integral meter options are available. An analog meter (option ME) is available with a 0 to 100% linear scale. The Smart Meter (option SM) provides an LCD display for both analog and digital output and can be configured to display pressure in pre-selected engineering units.

Lightning Protection
A terminal block is available with circuitry that protects the transmitter from transient surges induced by nearby lightning strikes.

HART Protocol Compatibility (Option HC)
An optional electronics module is available for the Series 900 that provides HART Protocol compatibility. Transmitters with the HART Option are compatible with the AMS System. (Contact your AMS Supplier if an upgrade is required.)

Configuration of the HART Option transmitter is accomplished using a Universal HART Communicator. For full functionality the communicator must contain the Honeywell Device Description (DD). Contact your nearest Honeywell office or distributor for further information regarding this option.

Tagging (Option TG)
Up to 30 characters can be added on the stainless steel nameplate mounted on the transmitter's electronics housing at no extra cost. Note that a separate nameplate on the meter body contains the serial number and body-related data. A stainless steel wired on tag with additional data of up to 4 lines of 28 characters is also available. The number of characters for tagging includes spaces.

Transmitter Configuration (Option TC)
The factory can configure the transmitter linear/square root extraction, damping time, LRV, URV and mode (analog/digital) and enter an ID tag of up to eight characters and scratchpad information as specified.

Custom Calibration and ID in Memory (Option CC)
The factory can calibrate any range within the scope of the transmitter's range and enter an ID tag of up to eight characters in the transmitter's memory.

FOUNDATION Fieldbus (Option FF)
Equips transmitter with FF protocol for use in 31.25 kbit/s FF networks. See document 34-ST-03-72 for additional information on ST 3000 Fieldbus transmitters.

Specifications are subject to change without notice.
(Note that specifications may differ slightly for transmitters manufactured before October 30, 1995.)

Ordering Information

Contact your nearest Honeywell sales office, or

In the U.S.:
Honeywell
Industrial Automation & Control
16404 N. Black Canyon Highway
Phoenix, AZ 85023
1-800-288-7491

In Canada:
The Honeywell Centre
155 Gordon Baker Rd.
North York, Ontario
M2H 3N7
1-800-461-0013

In Latin America:
Honeywell Inc.
480 Sawgrass Corporate Parkway,
Suite 200
Sunrise, FL 33325
(954) 845-2600

In Europe:
Honeywell PACE
1, Avenue du Bourget
B-1140 Brussels, Belgium
[32-2] 728-2111

In Asia:
Honeywell Asia Pacific Inc.
Room 3213-25
Sun Hung Kai Centre
No. 30 Harbour Road
Wanchai, Hong Kong
2829-8298

In the Pacific:
Honeywell Limited
5 Thomas Holt Drive
North Ryde NSW 2113
Australia
(61 2) 9353 7000

Or, visit Honeywell on the World Wide Web at:
http://www.honeywell.com

Model Selection Guide

34-ST-16-26, 28

Instructions

- Select the desired Key Number. The arrow to the right marks the selection available.
- Make one selection from each table, I and II, using the column below the proper arrow.
  Select as many Table III options as desired (if no options are desired, specify 00).
  A dot denotes unrestricted availability. A letter denotes restricted availability.
  Restrictions follow Table IV.

Key Number		I		II		III (Optional)		IV
_ _ _ _ _ _	-	_ _ _	-	_ _ _ _ _	-	_ _, _ _ _ _	+	XXXX

KEY NUMBER

Span		Selection	Availability	
Gage	0-20 to 0-500 psi/0-1.4 to 0-35 bar	STG944	↓	
	0-300 to 0-3000 psi/0-21 to 0-210 bar	STG974	↓	
Pressure	0-20 to 0-500 psi/0-1.4 to 0-35 bar	STG94L		↓
	0-300 to 0-3000 psi/0-21 to 0-210 bar	STG97L		↓
	0-500 to 0-6000 psi/0-35 to 0-415 bar	STG98L		↓

TABLE I - METER BODY

	Wetted Process Head ***	Vent/Drain Valve **	Barrier Diaphragms			
Material of Construction	Carbon Steel *	316 St. St.	316 LSS	A _ _	•	
	Carbon Steel *	316 St. St.	Hastelloy C	B _ _	•	
	316 St. St.	316 St. St.	316 LSS	E _ _	•	•
	316 St. St.	316 St. St.	Hastelloy C	F _ _	•	•
	Hastelloy C	Hastelloy C	Hastelloy C	J _ _	•	
Fill Fluid	Silicone DC200			_ 1 _	•	•
	CTFE			_ 2 _	•	•
Process Head Configuration	1/4" NPT			_ _ A	•	
	1/2" NPT with Adapter			_ _ G	t	
	1/2" NPT			_ _ G		•

TABLE II

No Selection	00000	•	•

***** Carbon Steel heads are zinc-plated. Not recommended for water service due to hydrogen migration. Use Stainless Steel heads.

****** Vent/Drains are Teflon coated for lubricity.

******* The standard reference head for the STG9XX is carbon steel (zinc-plated). See Table III for a stainless steel reference (HR) head option.

Note: End vent drain valve standard for STG9XX.

Model Selection Guide, continued

TABLE III - OPTIONS	Selection	Availability STG9 44 74	Availability STG9 4L 7L 8L	
None	00	•	•	
Viton Process Head Gaskets (teflon is standard)	VT	•		
Teflon Process Head Gaskets (viton is standard)	TF			
A286SS (NACE) Bolts and 302/304SS (NACE) Nuts for Heads	CR	•		
Analog Meter (0-100 Even 0-10 Square Root)	ME	•	•	
Smart Meter	SM	•	•	
Stainless Steel Customer Wired-On Tag (4 lines, 28 characters per line, customer supplied information)	TG	•	•	
Stainless Steel Customer Wired-On Tag (blank)	TB	•	•	
Adapter Flange - 1/2" NPT St. Steel	S1	c		
Adapter Flange - 1/2" NPT Hastelloy-C	T1	c		
Modified DIN Process Heads - 316SS	DN	w		
Mounting Bracket - Carbon Steel	MB	•	•	
Mounting Bracket - ST. ST.	SB	•	•	b
Flat Mounting Bracket - Carbon Steel	FB	•	•	
316 ST.ST. Electronics Housing with M20 Conduit Connections	SH	m	m	
1/2" NPT to M20 316SS Conduit Adapter (BASEEFA EEx d IIC)	A1	n	n	b
1/2" NPT to 3/4" NPT 316 SS Conduit Adapter	A2	u	u	
Side Vent/Drain	SV	d		
Custom Calibration and I.D. in Memory	CC	•	•	
Transmitter Configuration	TC	•	•	
Write Protection	WP	•	•	
Local Zero	LZ	x	x	b
Local Zero and Span	ZS	s	s	
Lightning Protection	LP	•	•	
St. St. Reference Head (Carbon Steel standard)	HR	•	•	
Clean Transmitter for Oxygen or Chlorine Service with Certificate	0X	h	h	
Over-Pressure Leak Test with F3392 Certificate	TP	•	•	
Additional Warranty - 1 year	W1	•	•	
Additional Warranty - 2 years	W2	•	•	b
Additional Warranty - 3 years	W3	•	•	
Additional Warranty - 4 years	W4	•	•	
Blind DIN SS Flanges Mounted with NACE Bolts	B1	y		
Low Temperature - -50°C Ambient Limit	LT	z	•	
Calibration Test Report and Certificate of Conformance (F3399)	F1	•	•	b
Certificate of Conformance (F3391)	F3	•	•	
Certificate of Origin (F0195)	F5	•	•	
NACE Certificate (F0198)	F7	o	o	
HART® Protocol Compatible Electronics	HC	e	e	b
FOUNDATION Fieldbus Communications	FF	r	r	

Table III continued next page

Model Selection Guide, continued

TABLE III - OPTIONS (continued)

Approval Body	Approval Type	Location or Classification	Selection	Availability STG9 44 74	Availability STG9 4L 7L 8L
No hazardous location approvals			9X	•	•
Factory Mutual	Explosion Proof	Class I, Div. 1, Groups A,B,C,D	1C	•	•
	Dust Ignition Proof	Class II, III Div. 1, Groups E,F,G			
	Non-Incendive	Class I, Div. 2, Groups A,B,C,D			
	Intrinsically Safe	Class I, II, III, Div. 1, Groups A,B,C,D,E,F,G			
CSA	Explosion Proof	Class I, Div. 1, Groups B,C,D	2J	•	•
	Dust Ignition Proof	Class II, III, Div. 1, Groups E,F,G			
	Intrinsically Safe	Class I, II, III, Div. 1, Groups A,B,C,D,E,F,G			
Zone 2 (Europe)	Self-Declared per 94/9/EC (ATEX4)	Ex II 3 GD T (1) X (1) T4 at Tamb. 93°C, T5 at Tamb. 80°C, T6 at Tamb. 65°C	3N	•	•
SA (Australia)	Intrinsically Safe	Ex ia IIC T4	4H	**a**	**a**
	Non-Incendive	Ex n IIC T6 (T4 with SM option)			
	Flame Proof	Ex d IIC T6			
LCIE	Flame Proof/ CENELEC	EEx d IIC T6	3A	•	•
	Intrinsically Safe/ CENELEC	EEx ia IIC T5			
	Flame Proof/ CENELEC	EEx d IIC T6	3D	•	•

TABLE IV

Factory Identification		XXXX	•	•

Model Selection Guide, continued

RESTRICTIONS

Restriction		Available Only With		Not Available With
Letter	**Table**	**Selection**	**Table**	**Selection**
a	Approval Body Pending			
b	Select only one option from this group			
c	I	_ _ G		
d			III	DN, B1
e	III	1C, 2J, 3D, 3N, 9X		
h	I	_ 2 _		
m			III	ZS, 1C, 2J
n			III	1C, 2J
o	III	CR or B1		
r	III	1C, 2J, 3A, 3D, 3N, 4H, 9X		
s			III	FF, ME
t		Select adapter from Table III S1, T1		
u	III	1C, 2J		
v	I	E _ G, F _ G		
w	I	E _ A, F _ A	III	SV
x	III	FF, SM		
y	I III	E _ A, F _ A DN	III	SV
z			III	STG974

Note: See 13:ST-29 and User's Manual for part numbers.
See 13:ST-OE-9 for OMS Order Entry Information including TC, manuals, certificates, drawings and SPINS.
See 13:ST-OD-1 for tagging, ID, Transmitter Configuration (TC) and calibration including factory default values.
To request a quotation for a non-published "special", fax RFQ to Marketing Applications.

Honeywell

Industrial Automation and Control
Honeywell Inc.
16404 North Black Canyon Highway
Phoenix, Arizona 85023-3099

Features

- Choice of single-head or in-line model to match process interface requirements.
- Direct digital integration with TDC 3000^X system provides local measurement accuracy to the system level without adding typical A/D and D/A converter inaccuracies.
- Unique piezoresistive sensor automatically compensates input for temperature.
- Added “smart” features include configuring lower and upper range values, simulating accurate analog output, and selecting preprogrammed engineering units for display.
- Smart transmitter capabilities with local or remote interfacing means significant manpower efficiency improvements in commissioning, start-up, and ongoing maintenance functions.

Description

The ST 3000 transmitter can replace any 4 to 20 milliampere output transmitter in use today, and operates over a standard two-wire system.

The measuring means is a piezoresistive sensor which actually contains a pressure sensor and a temperature sensor. Microprocessor-based electronics provide higher span-turndown ratio, improved temperature compensation, and improved accuracy.

Like other Smartline Transmitters, the ST 3000 features two-way communication between the operator and the transmitter through our SFC.

You can connect the SFC anywhere that you can access the transmitter signal lines, and it provides the capabilities of transmitter adjustments and diagnostics from remote locations, such as the control room.

The transmitter’s meter body and electronics housing resist shock, vibration, corrosion, and moisture. The electronics housing contains a compartment for the single-board electronics, which is isolated from an integral junction box. The single-board electronics is replaceable and interchangeable with any other ST 3000 Series 100 or Series 900 model transmitter.

Specifications

Operating Conditions – All Models

Parameter	Reference Condition		Rated Condition		Operative Limits		Transportation and Storage	
	°C	°F	°C	°F	°C	°F	°C	°F
Ambient Temperature	25±1	77±2	-40 to 85	-40 to 185	-40 to 93	-40 to 200	-55 to 125	-67 to 257
Meter Body Temperature	25±1	77±2	-40 to 110*	-40 to 230*	-40 to 125	-40 to 257	-55 to 125	-67 to 257
Humidity %RH	10 to 55		0 to 100		0 to 100		0 to 100	
Overpressure								
STG140, 14L **psi**	0		750		750			
bar	0		50		50			
STG170, 17L **psi**	0		4500		4500			
bar	0		310		310			
STG180, 18L **psi**	0		9000		9000			
bar	0		620		620			
Vacuum Region - Minimum Pressure								
mmHg absolute	atmospheric		25		2 (short term**)			
inH_2O absolute	atmospheric		13		1 (short term**)			
Supply Voltage, Current, and Load Resistance	**Voltage Range:** 10.8 to 42.4 Vdc at terminals **Current Range:** 3.0 to 21.8 mA **Load Resistance:** 0 to 1440 ohms (as shown in Figure 2)							

* For CTFE fill fluid the rating is –15 to 110 °C (5 to 230°F)

** Short term equals 2 hours at 70°C (158 °F)

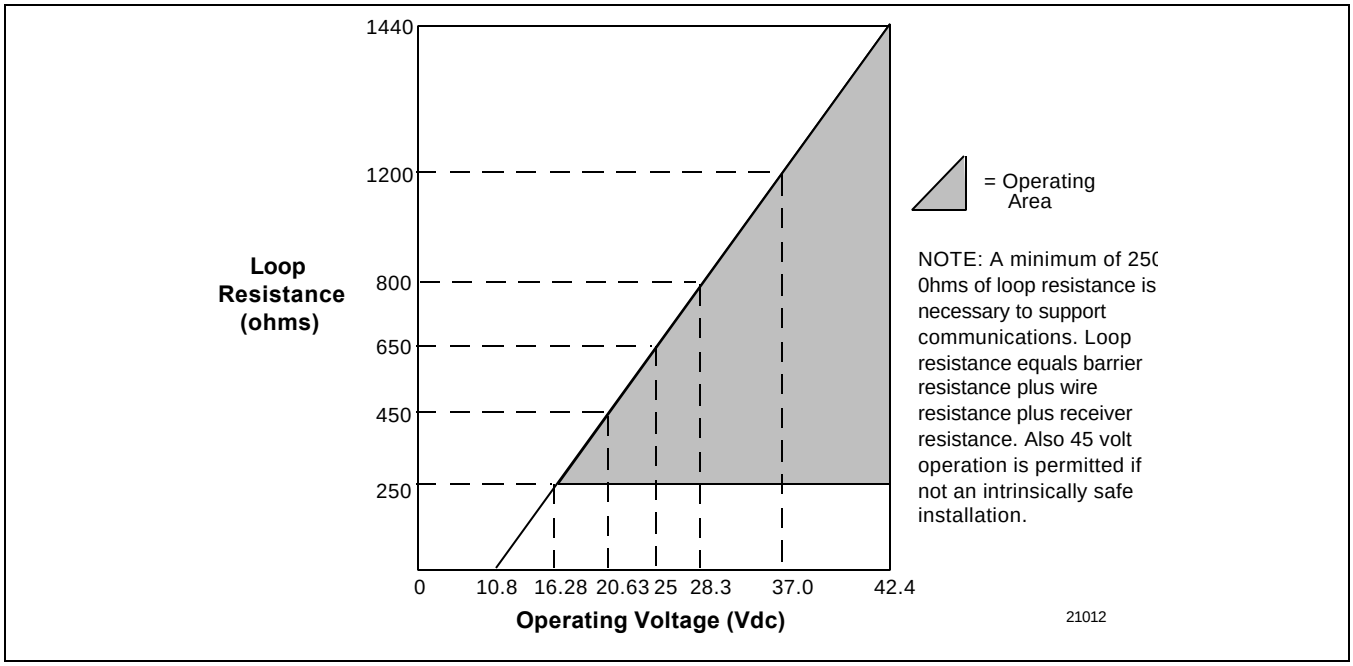


Figure 2 - Supply voltage and loop resistance chart.

Performance Under Rated Conditions* - Models STG140 & 14L (0 to 500 psi)

Parameter	Description
Upper Range Limit	**psi:** 500 **bar:** 35
Minimum Span	**psi:** 5 **bar:** 0.35
Turndown Ratio	100 to 1
Zero Elevation and Suppression	No limit except minimum span from absolute 0 (zero) to +100% URL. Specifications valid over this range.
Accuracy (Reference – Includes combined effects of linearity, hysteresis, and repeatability) • *Accuracy includes residual error after averaging successive readings.* • *For FOUNDATION Fieldbus use Digital Mode specifications. For HART use Analog Mode specifications.*	**In Analog Mode:** ±0.075% of calibrated span or upper range value (URV), whichever is greater, terminal based. For URV calibrated below reference point (20 psi), accuracy equals: $\pm 0.025 + 0.05 \left(\frac{20 \text{ psi}}{\text{span psi}}\right)$ or $\pm 0.025 + 0.05 \left(\frac{1.4 \text{ bar}}{\text{span bar}}\right)$ in % span **In Digital Mode:** ±0.0625% of calibrated span or upper range value (URV), whichever is greater, terminal based. For URV calibrated below reference point (20 psi), accuracy equals: $\pm 0.0125 + 0.05 \left(\frac{20 \text{ psi}}{\text{span psi}}\right)$ or $\pm 0.0125 + 0.05 \left(\frac{1.4 \text{ bar}}{\text{span bar}}\right)$ in % span
Zero Temperature Effect per 28°C (50°F)	**In Analog Mode:** ±0.0625% of span. For URV below reference point of 50 psi for model STG140 or 75 psi for model STG14L, effect equals: $\pm 0.0125 + 0.05 \left(\frac{50 \text{ psi}}{\text{span psi}}\right)$ or $\pm 0.0125 + 0.05 \left(\frac{3.5 \text{ bar}}{\text{span bar}}\right)$ in % span ***OR*** $\pm 0.0125 + 0.05 \left(\frac{75 \text{ psi}}{\text{span psi}}\right)$ or $\pm 0.0125 + 0.05 \left(\frac{5.25 \text{ bar}}{\text{span bar}}\right)$ in % span **In Digital Mode:** ±0.05% of span. For URV below reference point of 50 psi for model STG140 or 75 psi for model STG14L, effect equals: $\pm 0.05 \left(\frac{50 \text{ psi}}{\text{span psi}}\right)$ or $\pm 0.05 \left(\frac{3.5 \text{ bar}}{\text{span bar}}\right)$ in % span ***OR*** $\pm 0.05 \left(\frac{75 \text{ psi}}{\text{span psi}}\right)$ or $\pm 0.05 \left(\frac{5.25 \text{ bar}}{\text{span bar}}\right)$ in % span
Combined Zero and Span Temperature Effect per 28°C (50°F)	**In Analog Mode:** ±0.10% of span. For URV below reference point of 50 psi for model STG140 or 75 psi for model STG14L, effect equals: $\pm 0.05 + 0.05 \left(\frac{50 \text{ psi}}{\text{span psi}}\right)$ or $\pm 0.05 + 0.05 \left(\frac{3.5 \text{ bar}}{\text{span bar}}\right)$ in % span ***OR*** $\pm 0.05 + 0.05 \left(\frac{75 \text{ psi}}{\text{span psi}}\right)$ or $\pm 0.05 + 0.05 \left(\frac{5.25 \text{ bar}}{\text{span bar}}\right)$ in % span **In Digital Mode:** ±0.075% of span. For URV below reference point of 50 psi for model STG140 or 75 psi for model STG14L, effect equals: $\pm 0.025 + 0.05 \left(\frac{50 \text{ psi}}{\text{span psi}}\right)$ or $\pm 0.025 + 0.05 \left(\frac{3.5 \text{ bar}}{\text{span bar}}\right)$ in % span ***OR*** $\pm 0.025 + 0.05 \left(\frac{75 \text{ psi}}{\text{span psi}}\right)$ or $\pm 0.025 + 0.05 \left(\frac{5.25 \text{ bar}}{\text{span bar}}\right)$ in % span
Stability	±0.03% of URL per year

* Performance specifications are based on reference conditions of 25°C (77°F), 10 to 55% RH, and 316 Stainless Steel barrier diaphragm.

Performance Under Rated Conditions* - Models STG170 & 17L (0 to 3000 psi)

Parameter	Description
Upper Range Limit	**psi:** 3000 **bar:** 210
Minimum Span	**psi:** 100 **bar:** 7
Turndown Ratio	30 to 1
Zero Elevation and Suppression	No limit except minimum span from absolute 0 (zero) to +100% URL. Specifications valid over this range.
Accuracy (Reference – Includes combined effects of linearity, hysteresis, and repeatability) • *Accuracy includes residual error after averaging successive readings.* • *For FOUNDATION Fieldbus use Digital Mode specifications. For HART use Analog Mode specifications.*	**In Analog Mode:** ±0.075% of calibrated span or upper range value (URV), whichever is greater, terminal based. For URV calibrated below reference point (750 psi), accuracy equals: $\pm 0.025 + 0.05 \left(\frac{750 \text{ psi}}{\text{span psi}} \right)$ or $\pm 0.025 + 0.05 \left(\frac{52 \text{ bar}}{\text{span bar}} \right)$ in % span **In Digital Mode:** ±0.0625% of calibrated span or upper range value (URV), whichever is greater, terminal based. For URV calibrated below reference point (750 psi), accuracy equals: $\pm 0.0125 + 0.05 \left(\frac{750 \text{ psi}}{\text{span psi}} \right)$ or $\pm 0.0125 + 0.05 \left(\frac{52 \text{ bar}}{\text{span bar}} \right)$ in % span
Zero Temperature Effect per 28°C (50°F)	**In Analog Mode:** ±0.1125% of span. For URV below reference point (500 psi), effect equals: $\pm 0.0125 + 0.10 \left(\frac{500 \text{ psi}}{\text{span psi}} \right)$ or $\pm 0.0125 + 0.10 \left(\frac{35 \text{ bar}}{\text{span bar}} \right)$ in % span **In Digital Mode:** ±0.10% of span. For URV below reference point (500 psi), effect equals: $\pm 0.10 \left(\frac{500 \text{ psi}}{\text{span psi}} \right)$ or $\pm 0.10 \left(\frac{35 \text{ bar}}{\text{span bar}} \right)$ in % span
Combined Zero and Span Temperature Effect per 28°C (50°F)	**In Analog Mode:** ±0.175% of span. For URV below reference point (500 psi), effect equals: $\pm 0.075 + 0.10 \left(\frac{500 \text{ psi}}{\text{span psi}} \right)$ or $\pm 0.075 + 0.10 \left(\frac{35 \text{ bar}}{\text{span bar}} \right)$ in % span **In Digital Mode:** ±0.15% of span. For URV below reference point (500 psi), effect equals: $\pm 0.05 + 0.10 \left(\frac{500 \text{ psi}}{\text{span psi}} \right)$ or $\pm 0.05 + 0.10 \left(\frac{35 \text{ bar}}{\text{span bar}} \right)$ in % span
Stability	±0.03% of per year

* Performance specifications are based on reference conditions of 25°C (77°F), 10 to 55% RH, and 316 Stainless Steel barrier diaphragm.

Performance Under Rated Conditions* - Models STG180 & 18L (0 to 6000 psi)

Parameter	Description
Upper Range Limit	**psi:** 6000 **bar:** 415
Minimum Span	**psi:** 100 **bar:** 7
Turndown Ratio	60 to 1
Zero Elevation and Suppression	No limit except minimum span from absolute 0 (zero) to +100% URL. Specifications valid over this range.
Accuracy (Reference – Includes combined effects of linearity, hysteresis, and repeatability) • *Accuracy includes residual error after averaging successive readings.* • *For FOUNDATION Fieldbus use Digital Mode specifications. For HART use Analog Mode specifications.*	**In Analog Mode:** ±0.075% of calibrated span or upper range value (URV), whichever is greater, terminal based. For URV calibrated below reference point (1000 psi), accuracy equals: $\pm 0.025 + 0.10 \left(\frac{1500\,\text{psi}}{\text{span psi}}\right)$ or $\pm 0.025 + 0.10 \left(\frac{104\ \text{bar}}{\text{span bar}}\right)$ in % span **In Digital Mode:** ±0.125% of calibrated span or upper range value (URV), whichever is greater, terminal based. For URV calibrated below reference point (1000 psi), accuracy equals: $\pm 0.0125 + 0.10 \left(\frac{1500\,\text{psi}}{\text{span psi}}\right)$ or $\pm 0.0125 + 0.10 \left(\frac{104\ \text{bar}}{\text{span bar}}\right)$ in % span
Zero Temperature Effect per 28°C (50°F)	**In Analog Mode:** ±0.1125% of span. For URV below reference point (1000 psi), effect equals: $\pm 0.0125 + 0.10 \left(\frac{1000\ \text{psi}}{\text{span psi}}\right)$ or $\pm 0.0125 + 0.10 \left(\frac{70\ \text{bar}}{\text{span bar}}\right)$ in % span **In Digital Mode:** ±0.10% of span. . For URV below reference point (1000 psi), effect equals: $\pm 0.10 \left(\frac{1000\ \text{psi}}{\text{span psi}}\right)$ or $\pm 0.10 \left(\frac{70\ \text{bar}}{\text{span bar}}\right)$ in % span
Combined Zero and Span Temperature Effect per 28°C (50°F)	**In Analog Mode:** ±0.175% of span. For URV below reference point (1000 psi), effect equals: $\pm 0.075 + 0.10 \left(\frac{1000\ \text{psi}}{\text{span psi}}\right)$ or $\pm 0.075 + 0.10 \left(\frac{70\ \text{bar}}{\text{span bar}}\right)$ in % span **In Digital Mode:** ±0.15% of span. . For URV below reference point (1000 psi), effect equals: $\pm 0.05 + 0.10 \left(\frac{1000\ \text{psi}}{\text{span psi}}\right)$ or $\pm 0.05 + 0.10 \left(\frac{70\ \text{bar}}{\text{span bar}}\right)$ in % span
Stability	±0.03% of per year

* Performance specifications are based on reference conditions of 25°C (77°F), 10 to 55% RH, and 316 Stainless Steel barrier diaphragm.

Performance Under Rated Conditions - General for all Models

Parameter	Description
Output (two-wire)	Analog 4 to 20 mA or digital communications DE mode. Options available for FOUNDATION Fieldbus and HART protocol.
Supply Voltage Effect	0.005% span per volt.
Damping Time Constant	Adjustable from 0 to 32 seconds digital damping.
CE Conformity (Europe)	89/336/EEC, Electromagnetic Compatibility (EMC) Directive.
Lightning Protection Option (Code "LP")	Leakage Current: 10 microamps max. @ 42.4 VDC, 93°C Impulse Rating: 10/20 µ sec. 5,000 Amps (50 strikes) 10,000 Amps (20 strikes) (rise/decay) 10/1000 µ sec. 250 Amps (1000 strikes) 500 Amps (400 strikes)

Physical and Approval Bodies

Parameter	Description
Barrier Diaphragms Material	**Single-Head Meter Body:** 316L SS, Hastelloy C-276, Monel **In-Line Meter Body:** 316L SS, Hastelloy C-276
Process Head Material	**Single-Head Meter Body:** 316 SS, Carbon Steel (Zinc-plated), Hastelloy, Monel **In-Line Meter Body:** 316L SS
Head Gaskets	Teflon is standard. Viton is available with 316L SS and Monel barrier diaphragms.
Meter Body Bolting	Carbon Steel (Zinc plated, standard) or A286 SS (NACE) bolts and 302/304 SS (NACE) nuts for heads.
Mounting Bracket	Carbon Steel (Zinc-plated) or Stainless Steel angle bracket or Carbon Steel flat bracket available.
Fill Fluid	Silicone oil or CTFE (Chlorotrifluoroethylene)
Electronic Housing	Epoxy-Polyester hybrid paint. Low Copper-Aluminum. Meets NEMA 4X (watertight) and NEMA 7 (explosion proof). Stainless Steel Optional
Process Connections	**Single-Head Meter Body:** 1/2-inch NPT, 9/16-18 Aminco, DIN (standard option) **In-Line Meter Body:** 1/2-inch NPT
Wiring	Accepts up to 16 AWG (1.5 mm diameter).
Mounting	Can be mounted in virtually any position using the standard mounting bracket. Bracket is designed to mount on 2-inch (50 mm) vertical or horizontal pipe. See Figure 3 for single-head models and Figure 4 for in-line models.
Dimensions	See Figures 5 and 6.
Net Weight	**With Single-Head Meter Body:** 10 pounds (4.5 Kg) **With In-Line Meter Body:** 3.8 pounds (1.7 Kg)
Approval Bodies	Approved as explosion proof and intrinsically safe for use in Class I, Division 1, Groups A, B, C, D locations, and nonincendive for Class I, Division 2 Groups A, B, C, D locations. Approved EEx ia IIC T5 and EEx d IIC T6 per CENELEC standards; and Ex N II T5 per BS 6941.

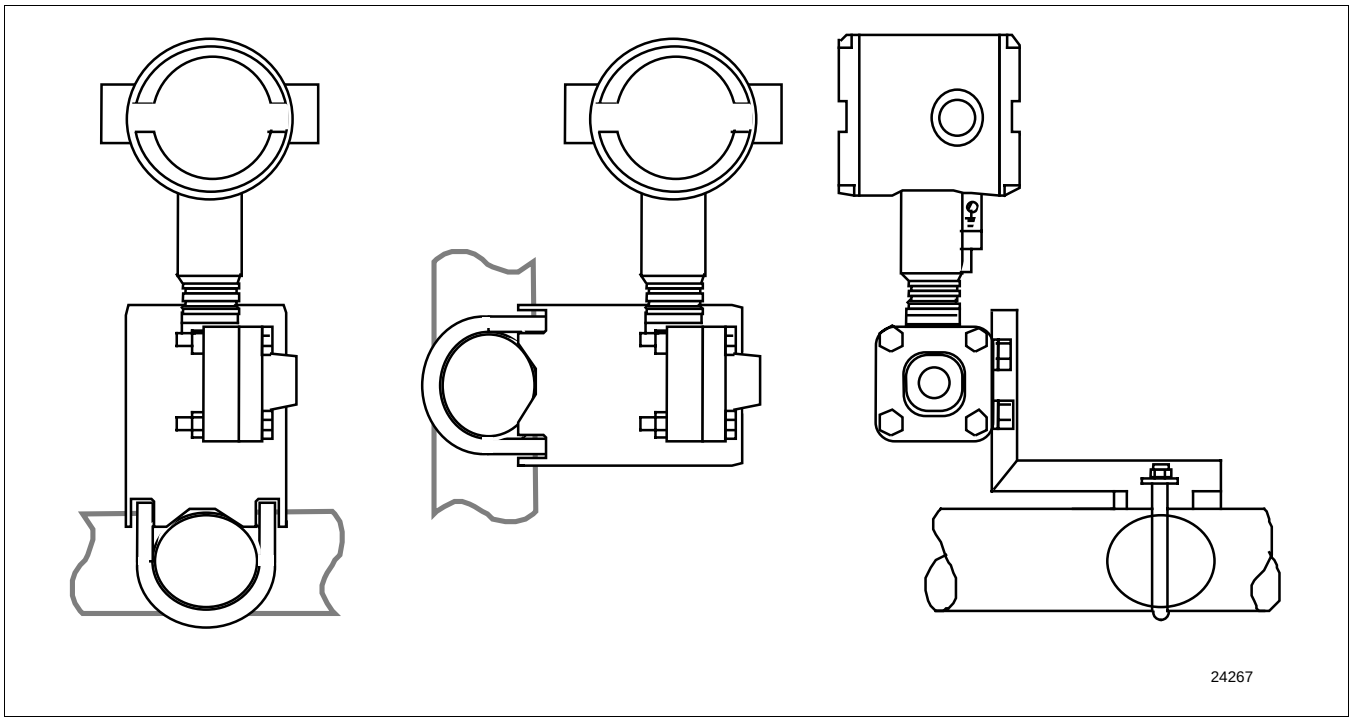


Figure 3 - Examples of typical mounting positions for single-head models STG140, STG170, and STG180.

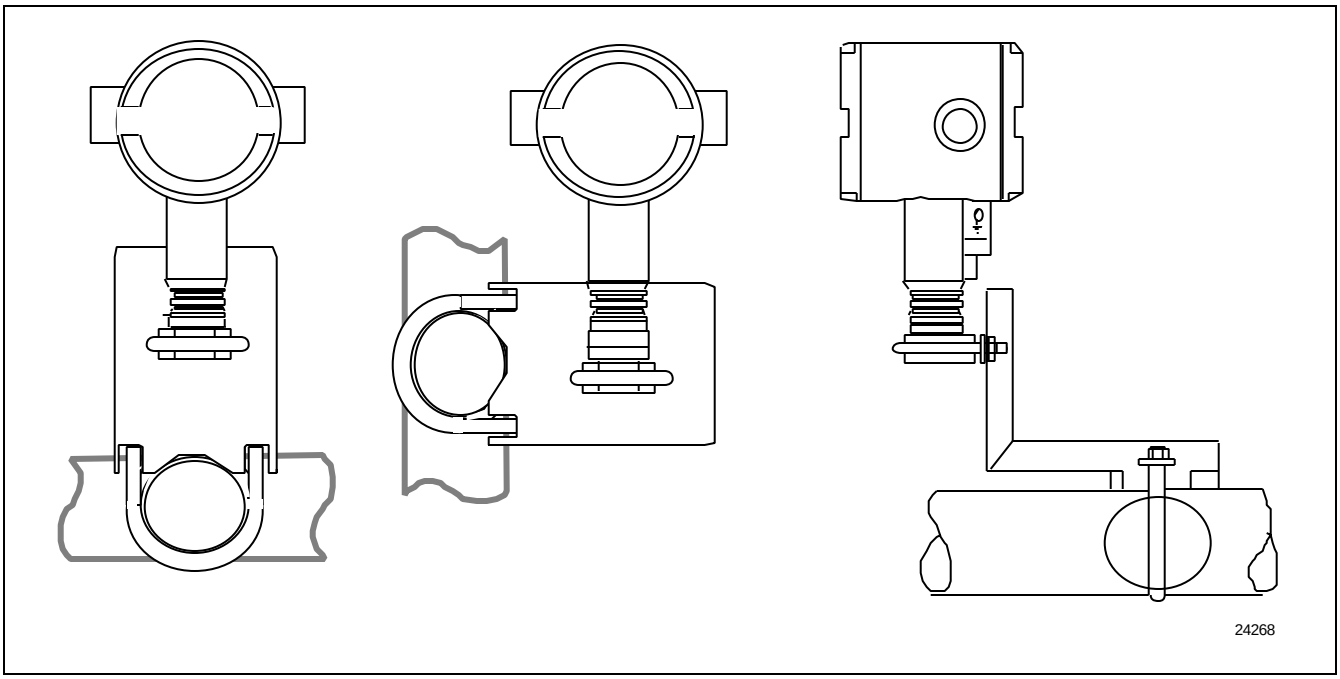


Figure 4 - Examples of typical mounting positions for in-line models STG14L, STG17L, and STG18L. Note that a mounting bracket is not required for in-line models.

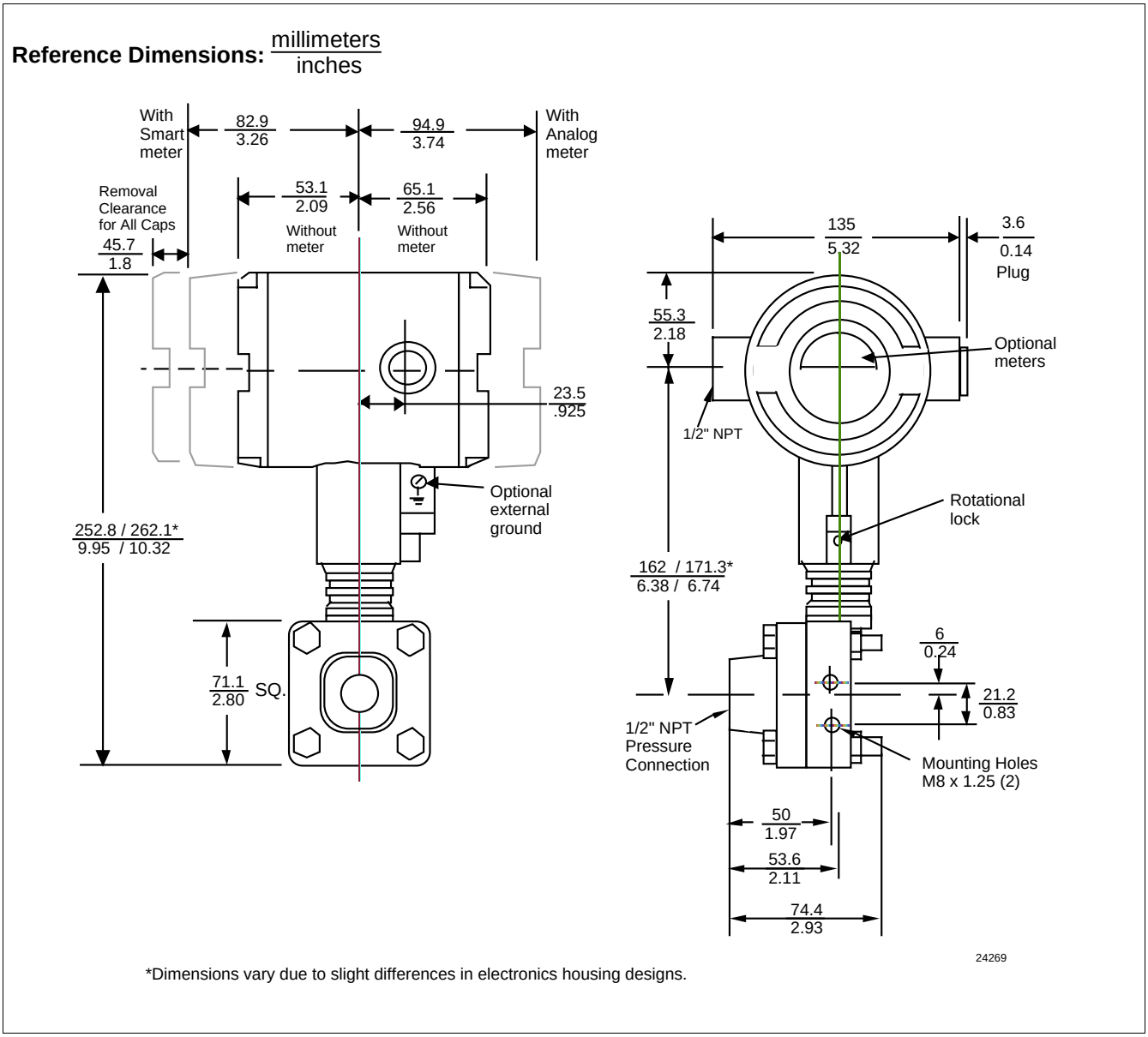
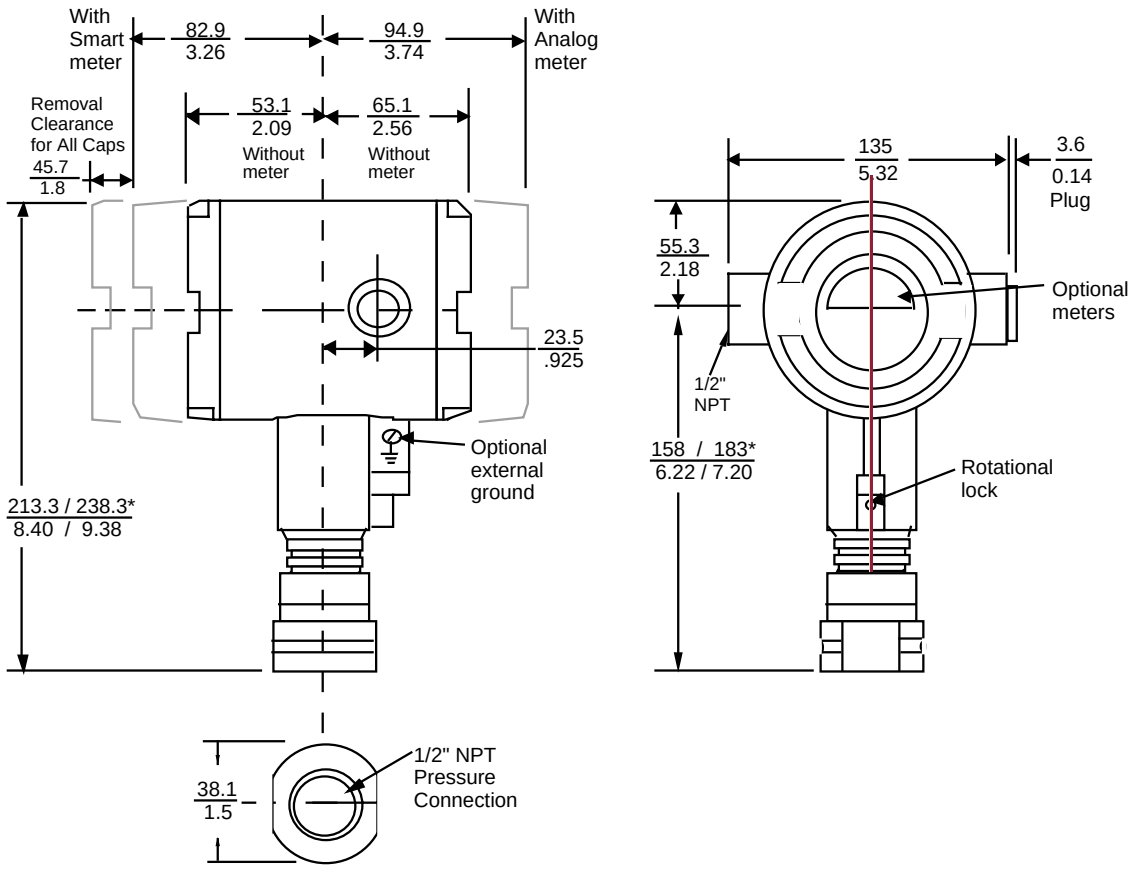


Figure 5 - Typical mounting dimensions for single-head models STG140, STG170, and STG180 for reference.

Reference Dimensions: millimeters / inches



*Dimensions vary due to slight differences in electronics housing designs.

Figure 6 - Typical mounting dimensions for in-line models STG14L, STG17L, and STG18L for reference.

Options

Mounting Bracket
The angle mounting bracket is available in either zinc-plated carbon steel or stainless steel and is suitable for horizontal or vertical mounting on a two inch (50 millimeter) pipe, as well as wall mounting. An optional flat mounting bracket is also available in carbon steel for two inch (50 millimeter) pipe mounting.

Indicating Meter
Two integral meter options are available. An analog meter (option ME) is available with a 0 to 100% linear scale. The Smart Meter (option SM) provides an LCD display for both analog and digital output and can be configured to display pressure in pre-selected engineering units.

HART Protocol Compatibility (Option HC)
An optional electronics module is available for the Series 100 that provides HART Protocol compatibility. Transmitters with the HART Option are compatible with the AMS System. (Contact your AMS Supplier if an upgrade is required.)

Lightning Protection
A terminal block is available with circuitry that protects the transmitter from transient surges induced by nearby lightning strikes.

Tagging (Option TG)
Up to 30 characters can be added on the stainless steel nameplate mounted on the transmitter's electronics housing at no extra cost. Note that a separate nameplate on the meter body contains the serial number and body-related data. A stainless steel wired on tag with additional data of up to 4 lines of 28 characters is also available. The number of characters for tagging includes spaces.

Transmitter Configuration (Option TC)
The factory can configure the transmitter linear/square root extraction, damping time, LRV, URV and mode (analog/digital) and enter an ID tag of up to eight characters and scratchpad information as specified.

Custom Calibration and ID in Memory (Option CC)
The factory can calibrate any range within the scope of the transmitter's range and enter an ID tag of up to eight characters in the transmitter's memory.

FOUNDATION Fieldbus (Option FF)
Equips transmitter with FF protocol for use in 31.25 kbit/s FF networks. See document 34-ST-03-72 for additional information on ST 3000 Fieldbus transmitters.

Ordering Information

Contact your nearest Honeywell sales office, or

In the U.S.:
Honeywell
Industrial Automation & Control
16404 N. Black Canyon Highway
Phoenix, AZ 85023
1-800-288-7491

In Canada:
The Honeywell Centre
155 Gordon Baker Rd.
North York, Ontario
M2H 3N7
1-800-461-0013

In Latin America:
Honeywell Inc.
480 Sawgrass Corporate Parkway,
Suite 200
Sunrise, FL 33325
(954) 845-2600

In Europe:
Honeywell PACE
1, Avenue du Bourget
B-1140 Brussels, Belgium
[32-2] 728-2111

In Asia:
Honeywell Asia Pacific Inc.
Room 3213-25
Sun Hung Kai Centre
No. 30 Harbour Road
Wanchai, Hong Kong
2829-8298

In the Pacific:
Honeywell Limited
5 Thomas Holt Drive
North Ryde NSW 2113
Australia
(61 2) 9353 7000

Or, visit Honeywell on the World Wide Web at:
http://www.honeywell.com

Specifications are subject to change without notice.

Model Selection Guide

34-ST-16-03

Instructions

- Select the desired Key Number. The arrow to the right marks the selection available.
- Make one selection from each Table I and II using the column below the proper arrow.
- Select as many Table III options as desired (if no options are desired, specify 00). A dot (•) denotes unrestricted availability. A letter denotes restricted availability. Restrictions follow Table IV.

Key Number		I		II		III (Optional)		IV
_ _ _ _ _ _	-	_ _ _	-	_ _ _ _ _	-	_ _, _ _	+	XXXX

KEY NUMBER

	Design	Span	Selection	Availability		
Gage Pressure	Head	0-5 to 0-500 psi/0-0.34 to 0-35 bar	STG140	↓		
		0-100 to 0-3000 psi/0-7 to 0-210 bar	STG170	↓		
		0-100 to 0-6000 psi/0-7 to 0-420 bar	STG180		↓	
	In-Line	0-5 to 0-500 psi/0-0.34 to 0-35 bar	STG14L			↓
		0-100 to 0-3000 psi/0-7 to 0-210 bar	STG17L			↓
		0-100 to 0-6000 psi/0-7 to 0-420 bar	STG18L			↓

TABLE I - METER BODY

	Wetted Process Heads	Vent/Drain Valves **	Barrier Diaphragms				
Materials of Construction	Carbon Steel *	-	316 LSS	A _ _	•	•	
	Carbon Steel *	-	Hastelloy C	B _ _	•	•	
	Carbon Steel *	-	Monel	C _ _	•		
	316 St. St.	-	316 LSS	E _ _	•	•	
	***	-	316 LSS	E _ _			•
	316 St. St.	-	Hastelloy C	F _ _	•	•	
	***	-	Hastelloy C	F _ _			•
	316 St. St.	-	Monel	G _ _	•		
	Hastelloy C	-	Hastelloy C	J _ _	•	•	
	Monel	-	Monel	L _ _	•		
Fill Fluid	Silicone DC200			_ 1 _	•	•	•
	CTFE			_ 2 _	•	•	•
Process Head Configuration	9/16" - 18 Aminco			_ _ A	•	•	
	1/2 NPT (female)			_ _ G	•	•	•

***** Carbon Steel heads are zinc-plated. Not recommended for water service due to hydrogen migration. Use Stainless Steel heads.

****** Vent/Drains are Teflon coated for lubricity.

******* STGIXL has 316 SS process interface.

Model Selection Guide, continued

TABLE II	Selection	Availability: STG140, STG170, STG180	Availability: STG14L	Availability: STG17L, STG18L
No Selection	00000	•	•	•

TABLE III - OPTIONS

None	00	•	•	•	
Mounting Bracket - Carbon Steel	MB	•	•	•	
Mounting Bracket - ST. ST.	SB	•	•	•	b
Flat Mounting Bracket - Carbon Steel	FB	•	•	•	
Viton Process Head Gasket (Teflon is standard)	VT	z			
Analog Meter (0-100 Even 0-10 Square Root)	ME	•	•	•	b
Smart Meter	SM	•	•	•	
Modified DIN Process Heads - 316SS	DN	w			
316 ST.ST. Electronics Housing with M20 Conduit Connections	SH	n	n	n	
1/2" NPT to M20 316SS Conduit Adapter (BASEEFA EEx d IIC)	A1	n	n	n	b
1/2" NPT to 3/4" NPT 316 SS Conduit Adapter	A2	u	u	u	
Lightning Protection	LP	•	•	•	
Custom Calibration and I.D. in Memory	CC	•	•	•	
Transmitter Configuration - non-Fieldbus	TC	•	•	•	b
Transmitter Configuration - Fieldbus	FC	a	a	a	
Write Protection	WP	•	•	•	
A286SS (NACE) Bolts and 302/304SS (NACE) Nuts for Head	CR	•			
Stainless Steel Customer Wired-On Tag (4 lines, 28 characters per line, customer supplied information)	TG	•	•	•	
Stainless Steel Customer Wired-On Tag (blank)	TB	•	•	•	
Clean Transmitter for Oxygen or Chlorine Service with Certificate	0X	h	h	h	
Over-Pressure Leak Test with F3392 Certificate	TP	•	•	•	
Additional Warranty - 1 year	W1	•	•	•	
Additional Warranty - 2 years	W2	•	•	•	
Additional Warranty - 3 years	W3	•	•	•	b
Additional Warranty - 4 years	W4	•	•	•	
Calibration Test Report and Certificate of Conformance (F3399)	F1	•	•	•	
Certificate of Conformance (F3391)	F3	•	•	•	b
Certificate of Origin (F0195)	F5	•	•	•	
NACE Certificate (F0198)	F7	o	•	•	
FOUNDATION Fieldbus Communications	FF	r	r	r	b
HART Protocol compatible electronics	HC	e	e	e	
Local Zero & Span	ZS	m	m	m	b
Local Zero	LZ	x	x	x	

Table III options continued on next page

Model Selection Guide, continued

Availability

STG140, STG170, STG180 | **STG14L** | **STG17L, STG18L**

TABLE III - OPTIONS (continued)

Approval Body	Approval Type	Location or Classification	Selection				
No hazardous location approvals			9X	•	•	•	
Factory Mutual	Explosion Proof	Class I, Div. 1, Groups A,B,C,D	1C	•	•	•	
	Dust Ignition Proof	Class II, III Div. 1, Groups E,F,G					
	Non-Incendive	Class I, Div. 2, Groups A,B,C,D					
	Intrinsically Safe	Class I, II, III, Div. 1, Groups A,B,C,D,E,F,G					
CSA	Explosion Proof	Class I, Div. 1, Groups B,C,D	2J	•	•	•	b
	Dust Ignition Proof	Class II, III, Div. 1, Groups E,F,G					
	Intrinsically Safe	Class I, II, III, Div. 1, Groups A,B,C,D,E,F,G					
Zone 2 (Europe)	Self-Declared per 94/9/EC (ATEX4)	Ex II 3 GD T (1) X (1) T4 at Tamb. 93°C, T5 at Tamb. 80°C, T6 at Tamb. 65°C	3N	•	•	•	
SA (Australia)	Intrinsically Safe	Ex ia IIC T4	4H	**a**	**a**	**a**	
	Non-Incendive	Ex n IIC T6 (T4 with SM option)					
	Flame Proof	Ex d IIC T6					
LCIE	Flame Proof/ CENELEC	EEx d IIC T6	3A	•	•	•	
	Intrinsically Safe/ CENELEC	EEx ia IIC T5					
	Flame Proof/ CENELEC	EEx d IIC T6	3D	•	•	•	

TABLE IV

Factory Identification	XXXX	•	•	•

RESTRICTIONS

Restriction Letter	Available Only With Table	Available Only With Selection	Not Available With Table	Not Available With Selection
a	Pending			
b	Select only one option from this group			
e	III	1C, 2J, 3N, 3D, 9X		
h		_ 2 _		
m			III	ME, FF
n			III	1C, 2J
o	III	CR		
r			III	TC, ME
u	III	1C, 2J		
w	I	E _ G, F _ G, G _ G		
x	III	FF, SM		
z			I	B _ _, F _ _, J _ _

Note: See 13:ST-27 for Published Specials with pricing.
See 13:ST-29 and User's Manual for part numbers.
See 13:ST-OE-9 for OMS Order Entry Information including TC, manuals, certificates, drawings and SPINS.
See 13:ST-OD-1 for tagging, ID, Transmitter Configuration (TC) and calibration including factory default values.
To request a quotation for a non-published "special", fax RFQ to Marketing Applications.

Honeywell

Industrial Automation and Control
Honeywell Inc.
16404 North Black Canyon Highway
Phoenix, Arizona 85023-3099